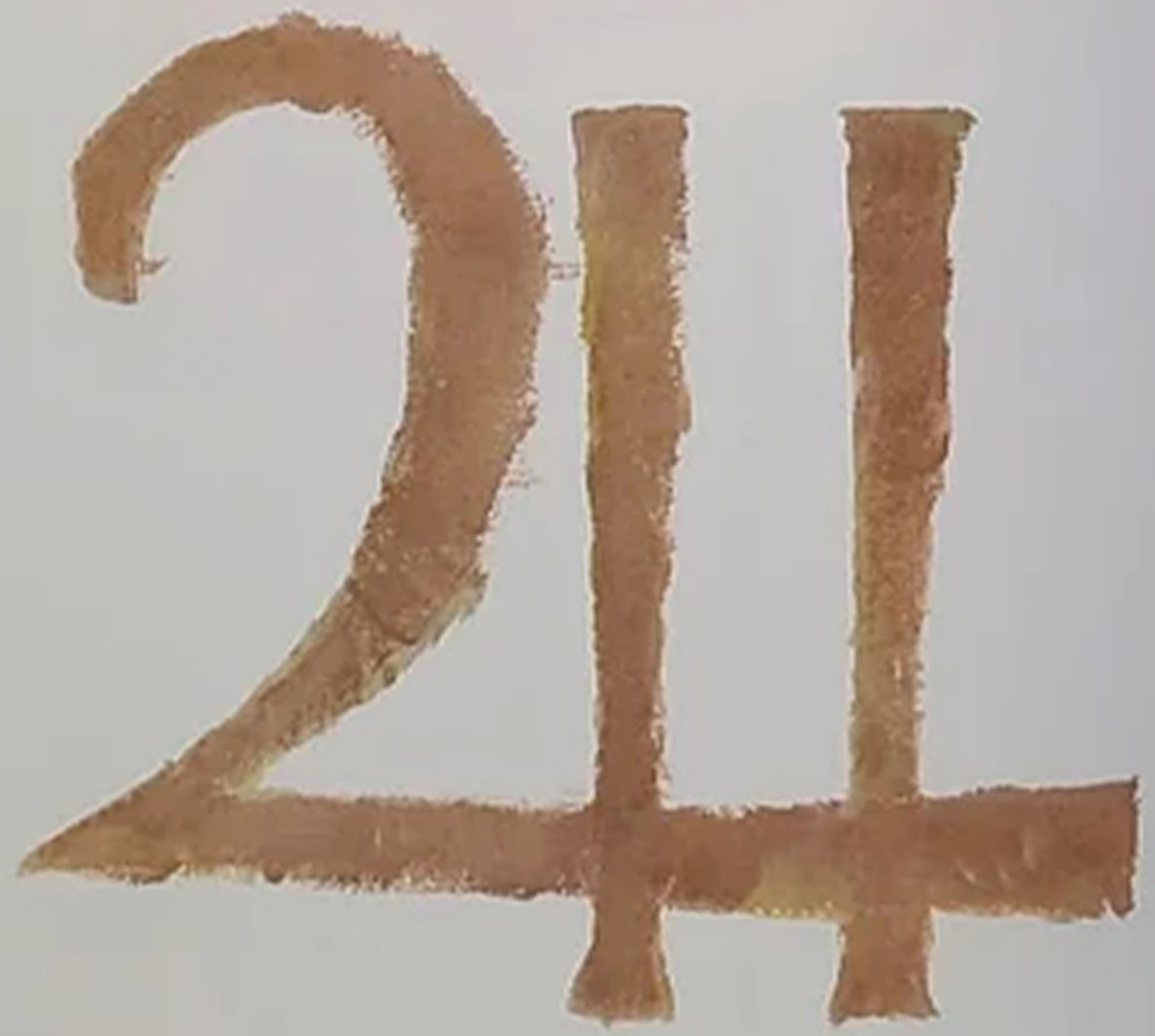
Concepts



Created and produced under the direction of the Advertising and Market Development Division of United States Steel by the Herman Schwartz, 307 N. Michigan Avenue, Chicago 1, Illinois

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In the Tapestry of Time—
Steel Binds Dreams to Reality

Early in recorded history, the Alchemist had this symbol for iron. This mark reminds us that centuries ago iron was recognized and identified as one of the vital elements of life.

At the turn of the last century the probing mind of man, looking to frontiers with a beginning but without end, developed the steel making process. Since then thousands of steels have been created for special needs, a few of which have been discussed in this book.

For the most part, stylists and designers work with brush and sculptured clay. However, the engineers and the metallurgists need additional tools, tools for exact measurements, for theirs is a science rather than an art. It is for these scientifically trained people that the following pages of this book are presented, to serve for quick reference or comparative study.

As new forms and shapes in steel change the "look" of tomorrow's world, even newer steels will be created in answer to design challenges yet unforeseen. As your own design, engineering and manufacturing challenges arise, our people, products and creative services are available to help you solve them. Address all inquiries to our nearest district sales office listed under United States Steel in your directory, or to:

Automotive Industries, Market Development Division,
525 William Penn Place, Pittsburgh 30, Pennsylvania

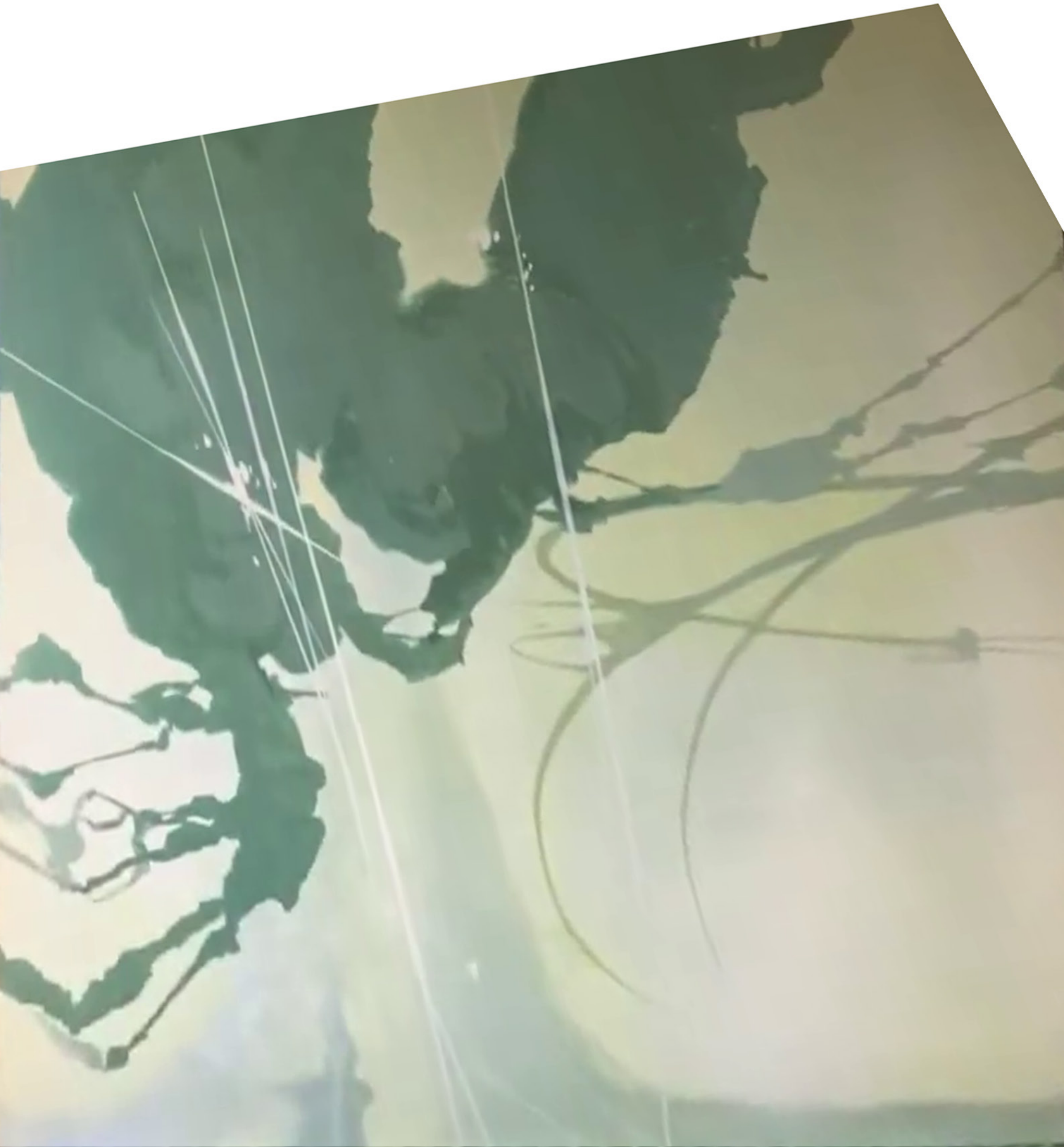
United States Steel Corporation
American Steel & Wire
National Tube
United States Steel



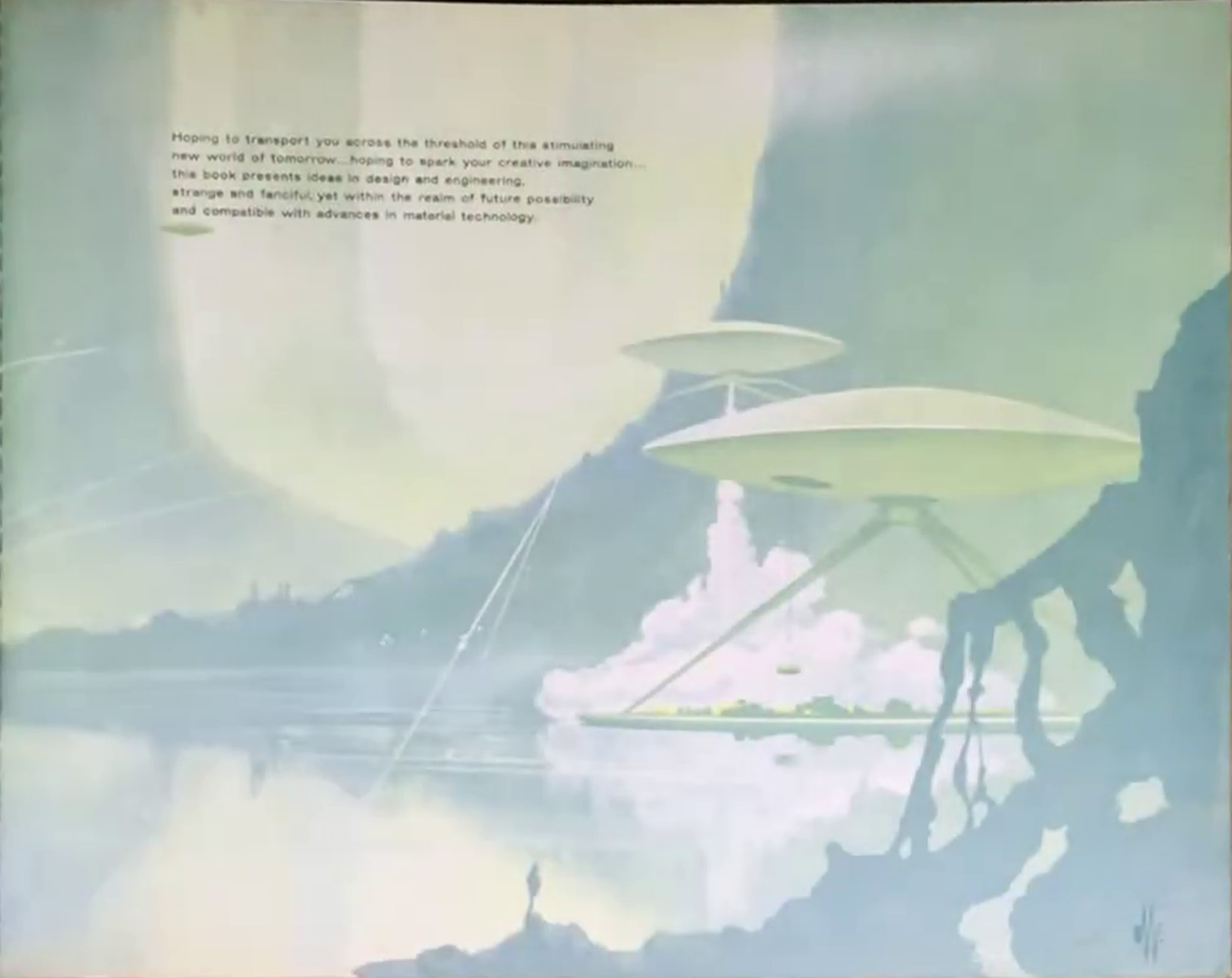


Concepts...

Creative imagination of the designer and engineer
give impetus to the emergence of an exciting new world...
a world of imagination unfettered...
a world of design creativity...
a bold new world of ideas!



Hoping to transport you across the threshold of this stimulating
new world of tomorrow...hoping to spark your creative imagination...
this book presents ideas in design and engineering,
strange and fanciful, yet within the realm of future possibility
and compatible with advances in material technology.





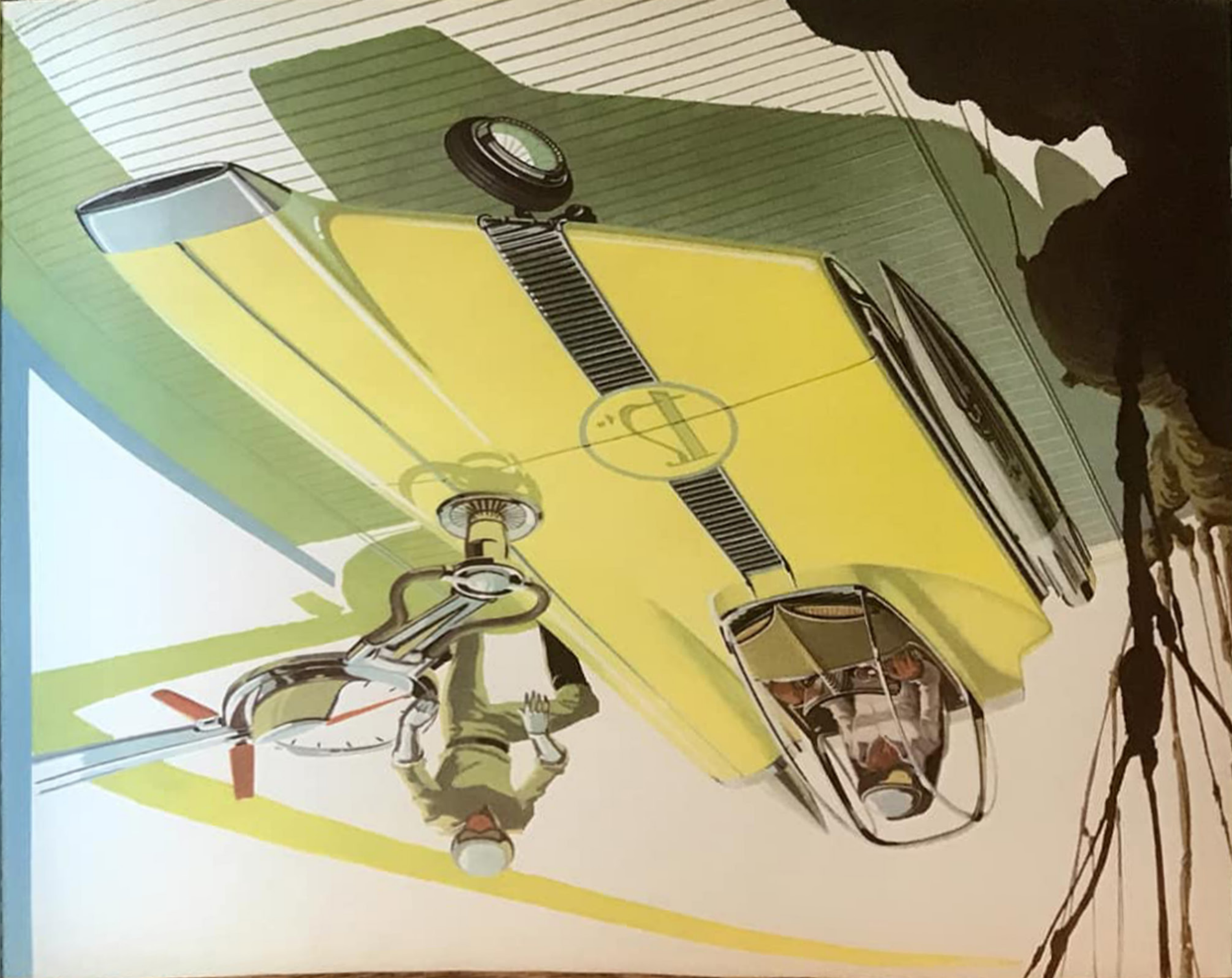
Today's Dream—Tomorrow's Reality

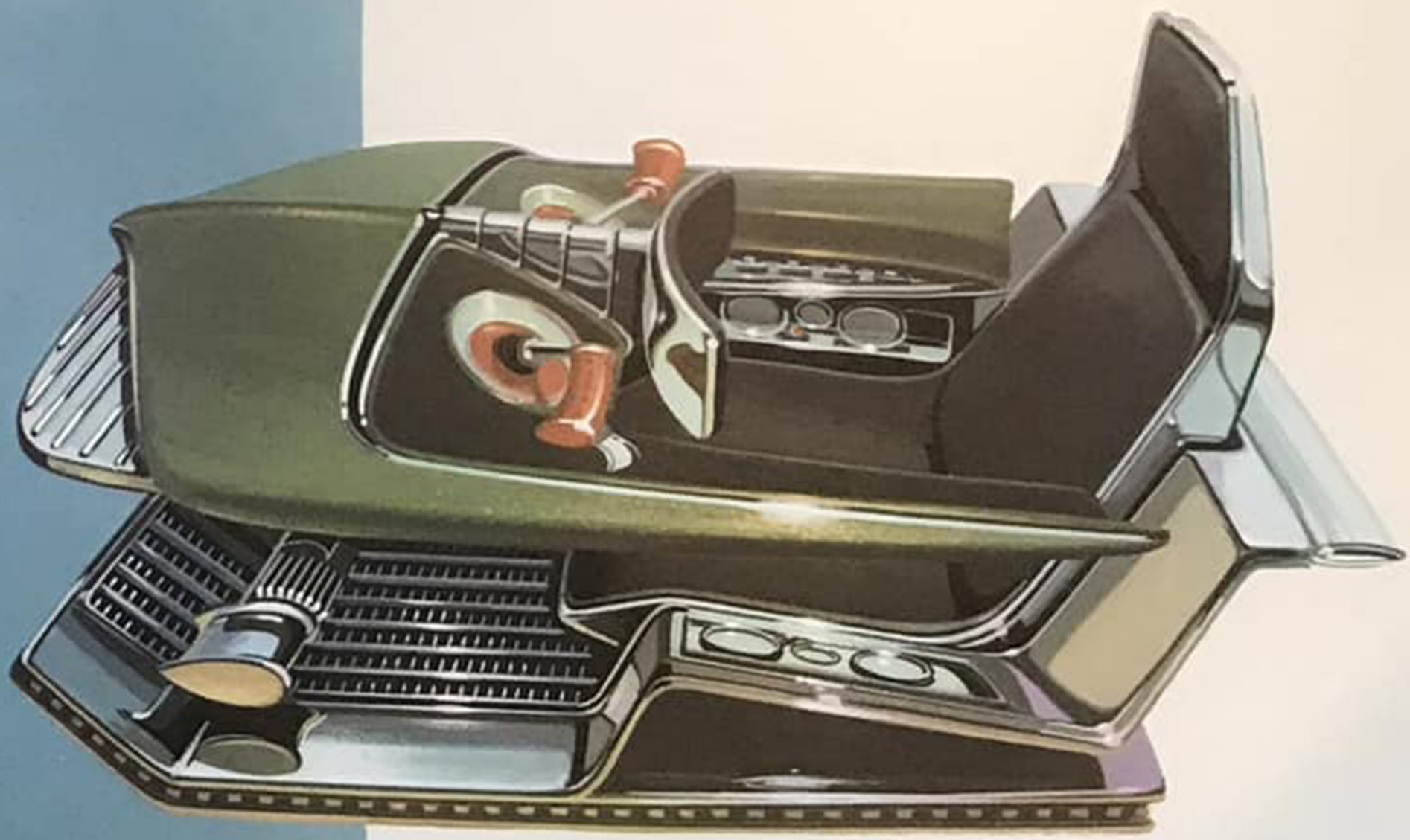
In the strange world of tomorrow—a
world sometimes difficult to imagine—changes will be dynamic.

Tendril-like highways will bridge primordial bogs,
tap resources in the savage heat of the desert,
or supply a city beneath the biting cold of a polar cap.

In this new world, new shapes, new forms will
evolve. And steel, with its incomparable application and
design flexibility, will continue to pace progress into tomorrow.



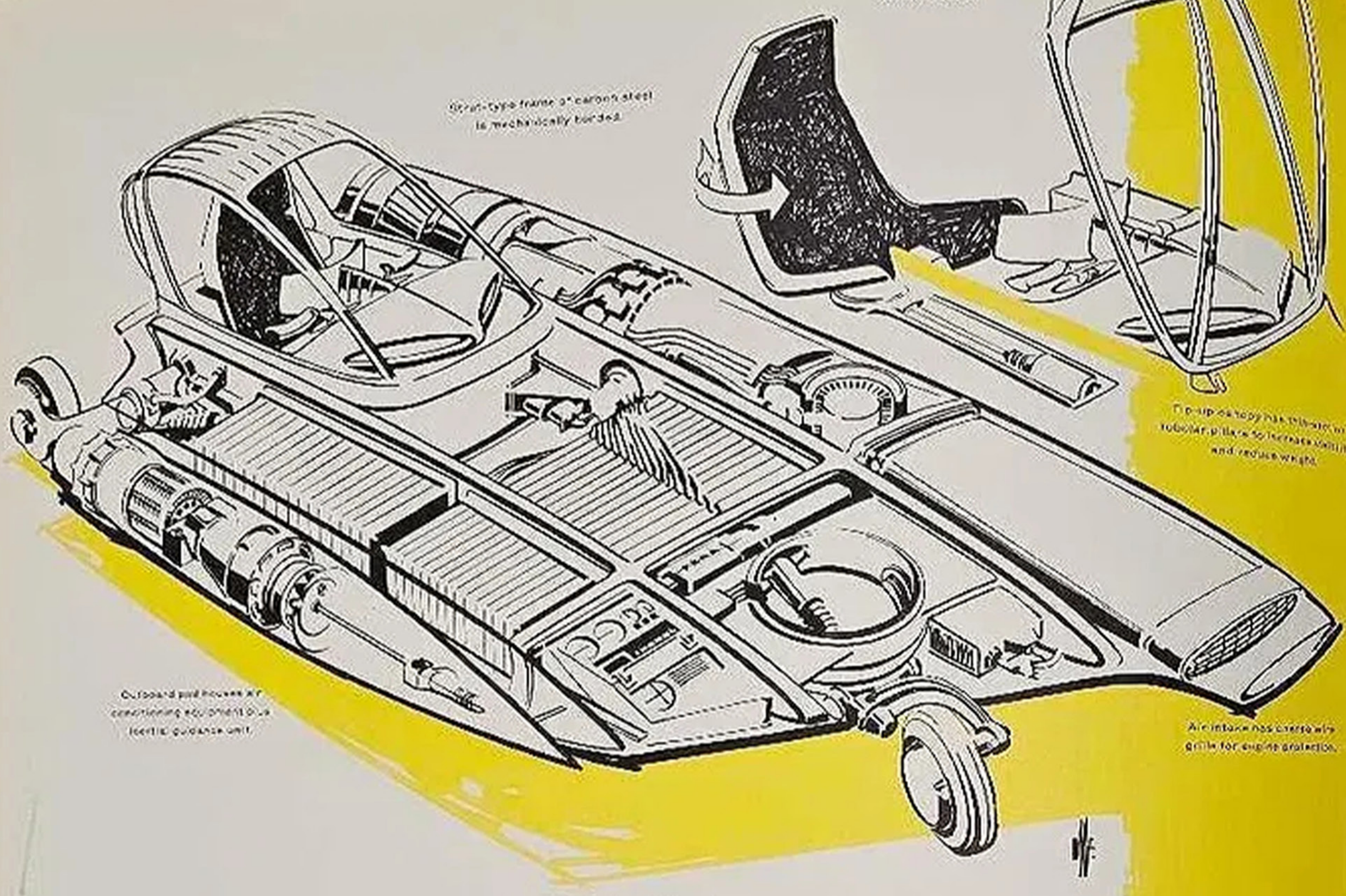




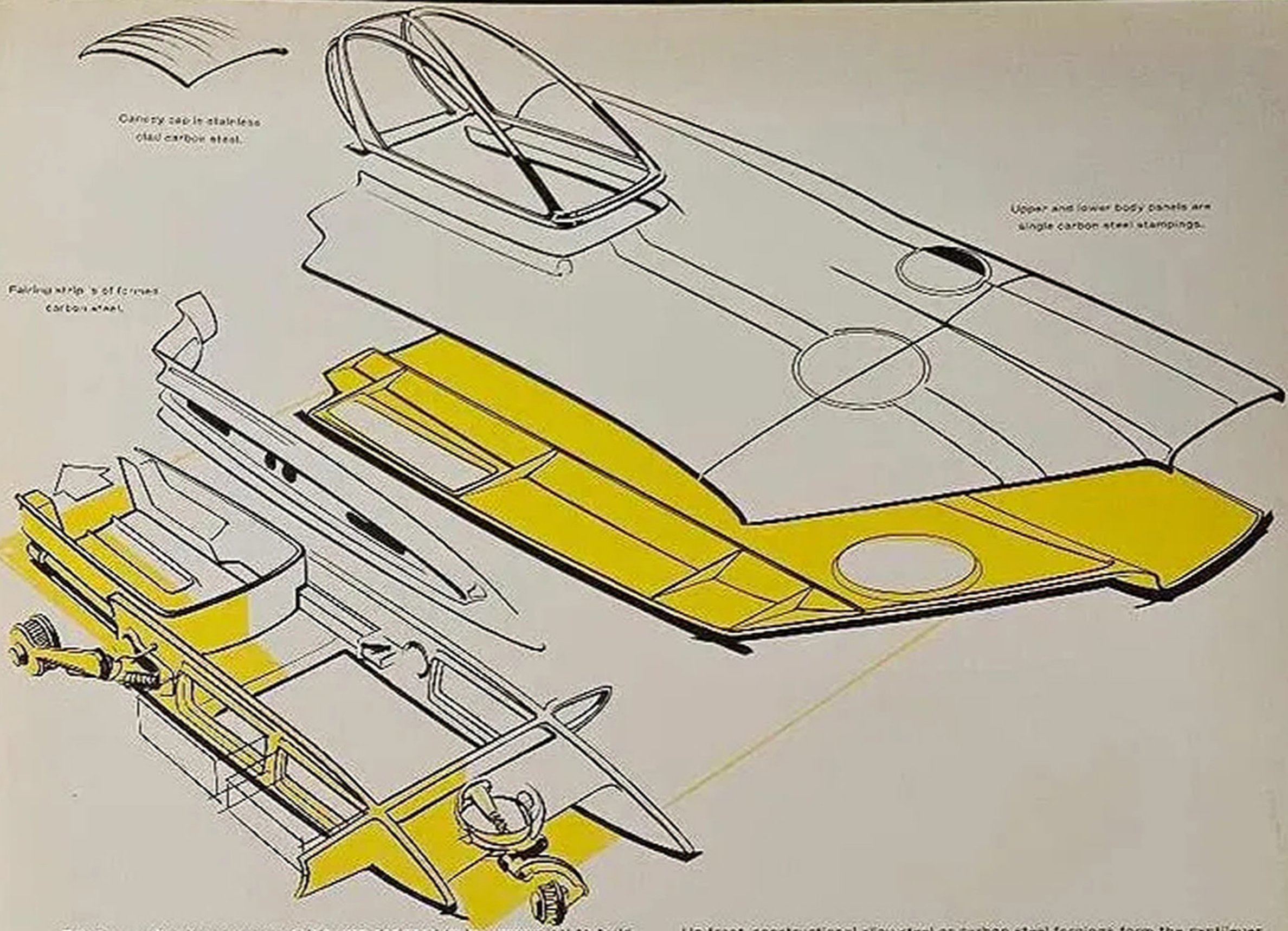
A Quickened Pace with Advanced Technology

Transportation in tomorrow's business world will be measured not in miles but in thousands of miles and executives will be carried across these miles at high speeds in compact vehicles. It is for such fast, one-man travel that this car is designed.

The stressed skin utilizes well known economies possible with carbon steel sheet. Accents in Vinyl Coated steel and brushed stainless steel give luster and durability to the control center.



Fuel tanks are fabricated of stainless USS SX-TEN steel tubing.



This low-profile, jet-powered vehicle was designed to be economical to build and operate.

Carbon steel is specified for body panels on this vehicle. Panels may be either galvanized or aluminum coated on the inside to resist corrosion.

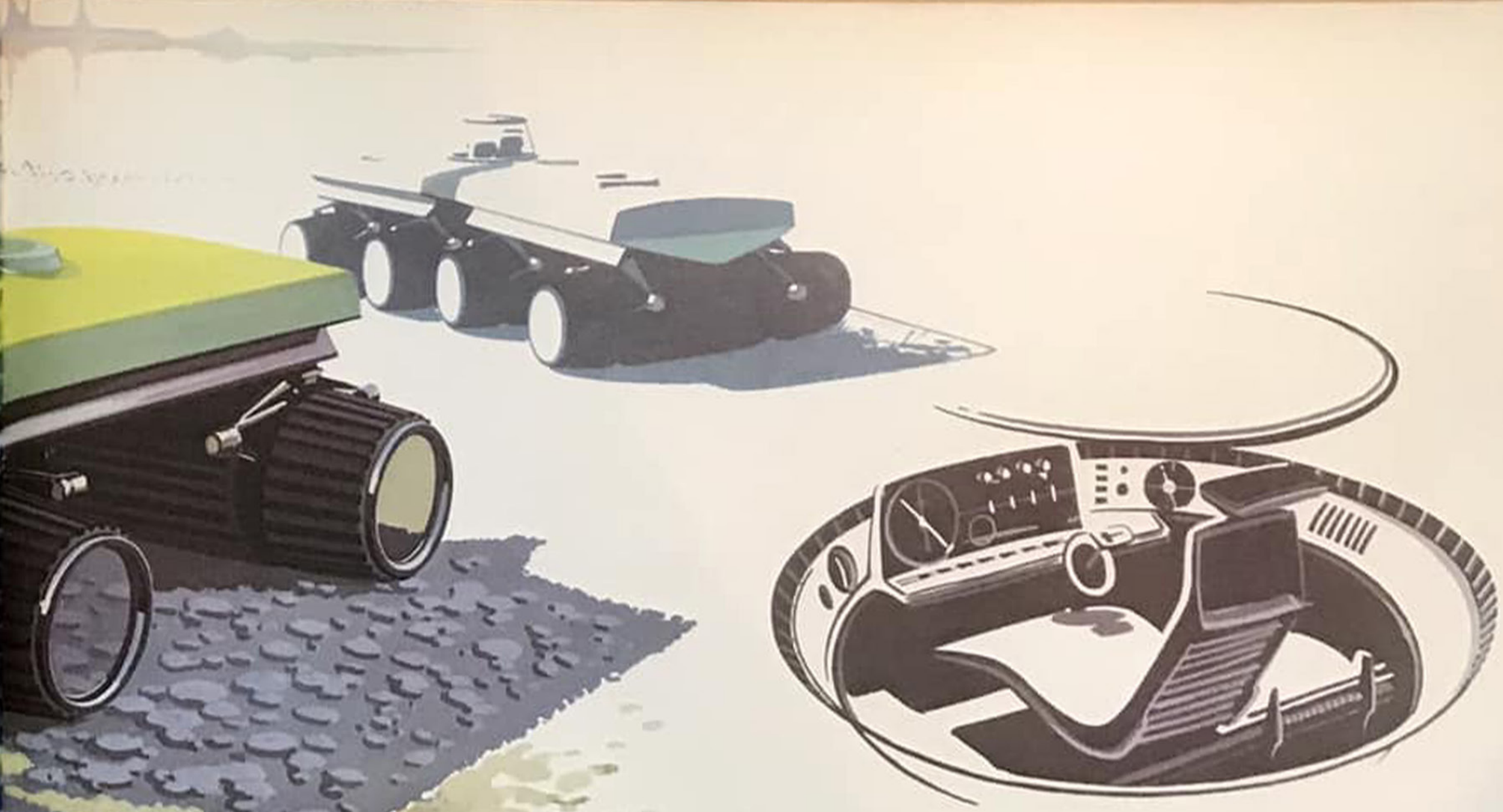
Husky frame members are stamped of carbon steel. The high pressure fuel tanks of USS F-X TEN steel are nested inside the frame members.

Up front, constructional alloy steel or carbon steel forgings form the cantilever half-fork axle.

Seamless tubing and free-machining steels are combined in the front and rear suspension to provide light, yet extremely strong, assemblies.

Only carbon steel offers the designer so many advantages: strength, weldability, formability, drawability, ease of fabrication, surface finish and low cost.

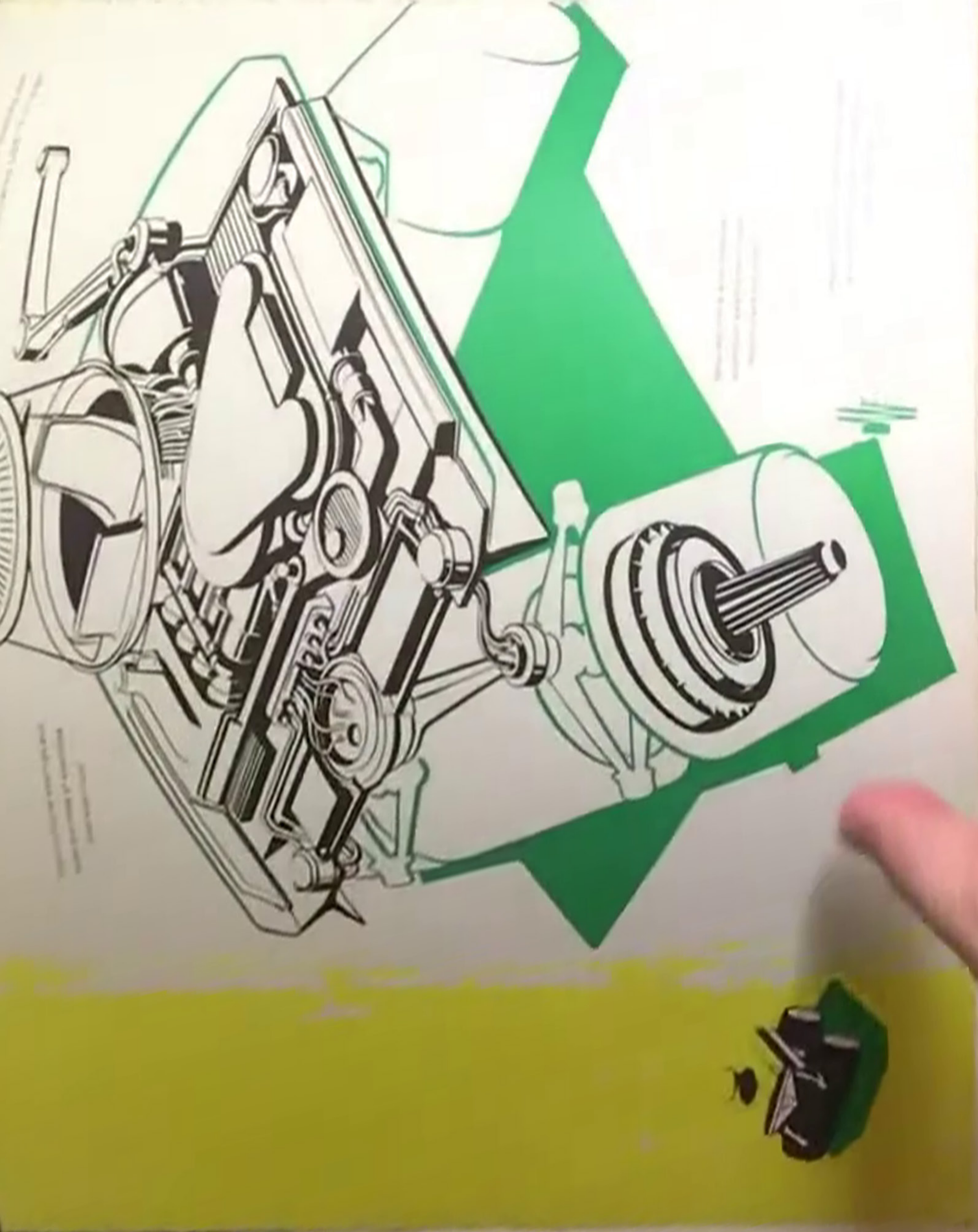


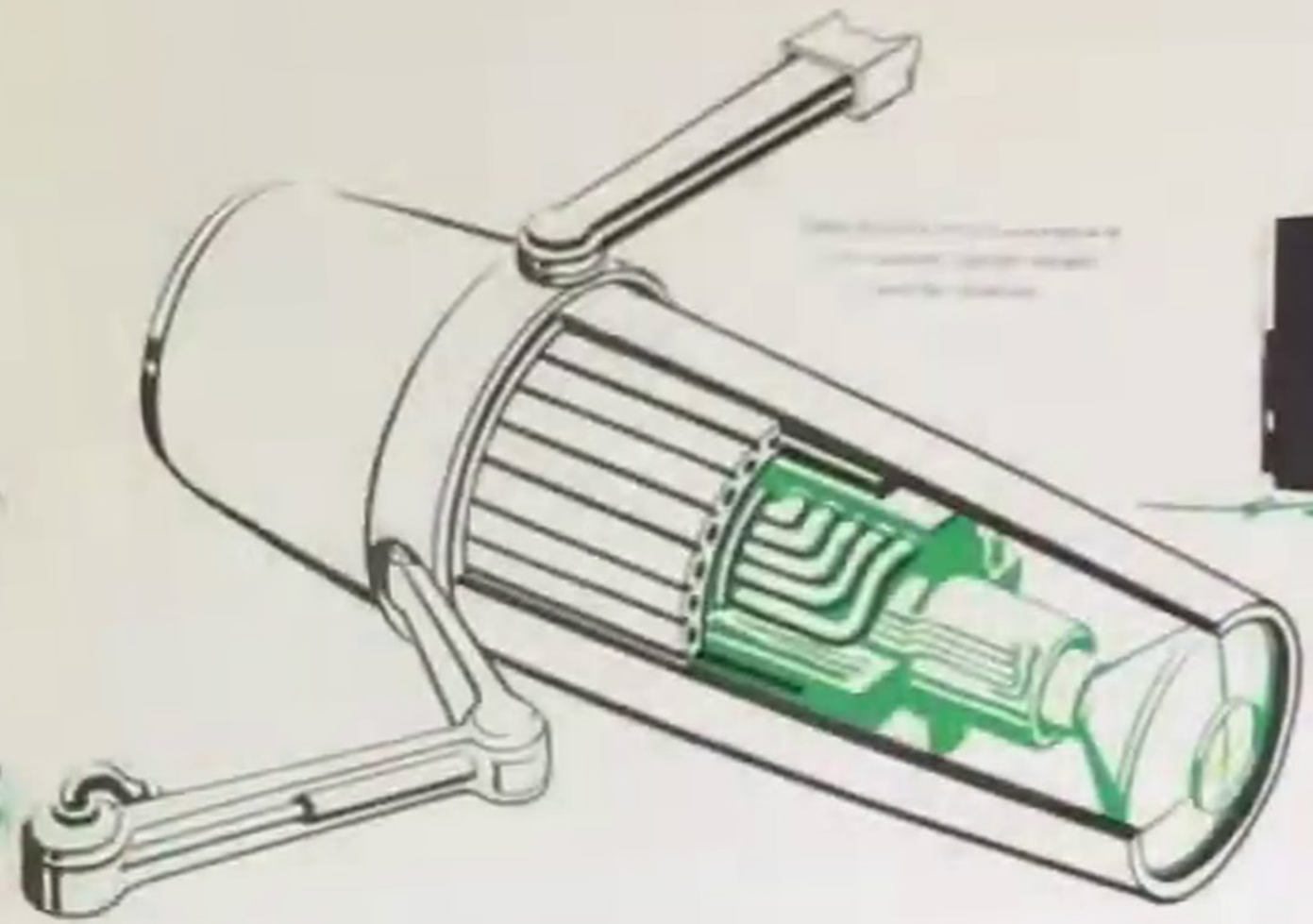


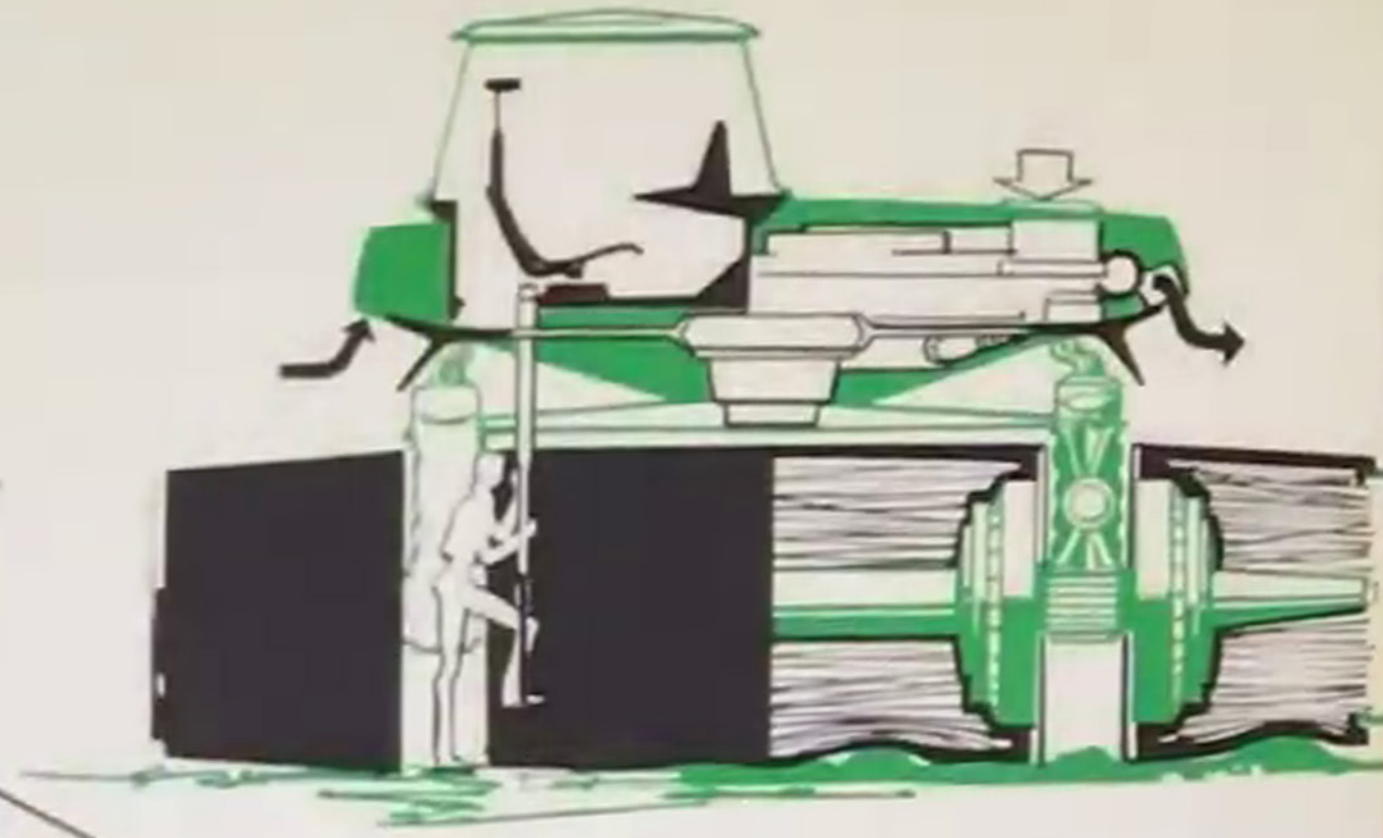
Today a Mountain...Tomorrow a Roadway

Advances in science will bring developments only imagined in today's world. Tomorrow will see tough USS "T-1" steel used in blasting equipment yet to appear on the engineer's drawing board.

This equipment must be designed to resist severe shock loads and moderately high temperatures. USS "T-1" steel is the ideal material for the construction of this unit's tractor, blasting pod, and shielded power source.

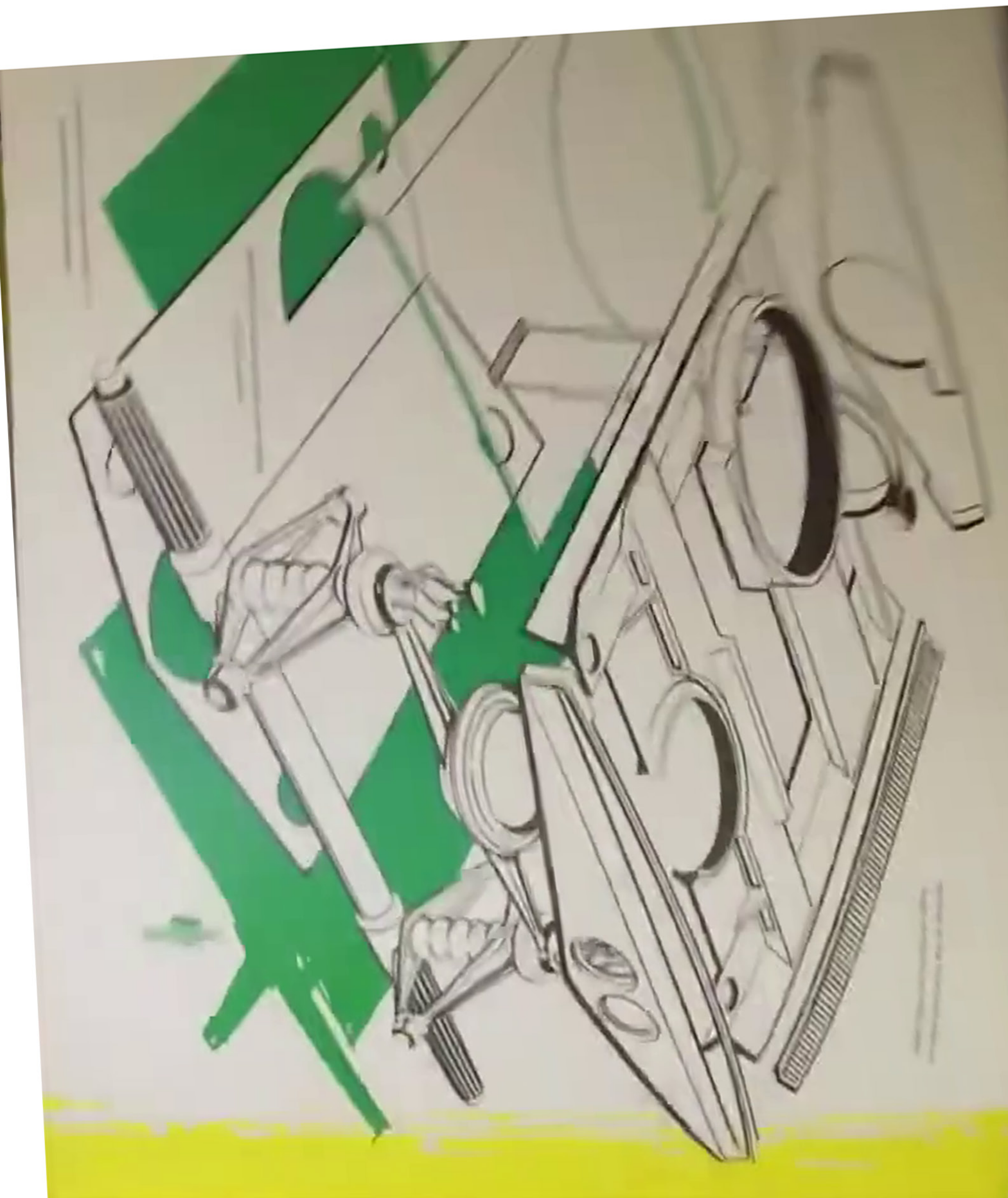






A big machine for a big job. The engineers specify USS "T-1" steel for fabricated frames and body members because USS "T-1" steel is the tough steel: it has high yield strength, is weldable, and offers high (over the resistance to abrasion/impact corrosion) and three times the (over) rupture strength of carbon steel.

The working part is a USS "T-1" steel casting with ceramic liner. Such parts must withstand tremendous abrasion and impact. Here USS "T-1" steel's high strength and durability is a distinct advantage in weight and service life. Stainless steel resists the elements but not abrasion.





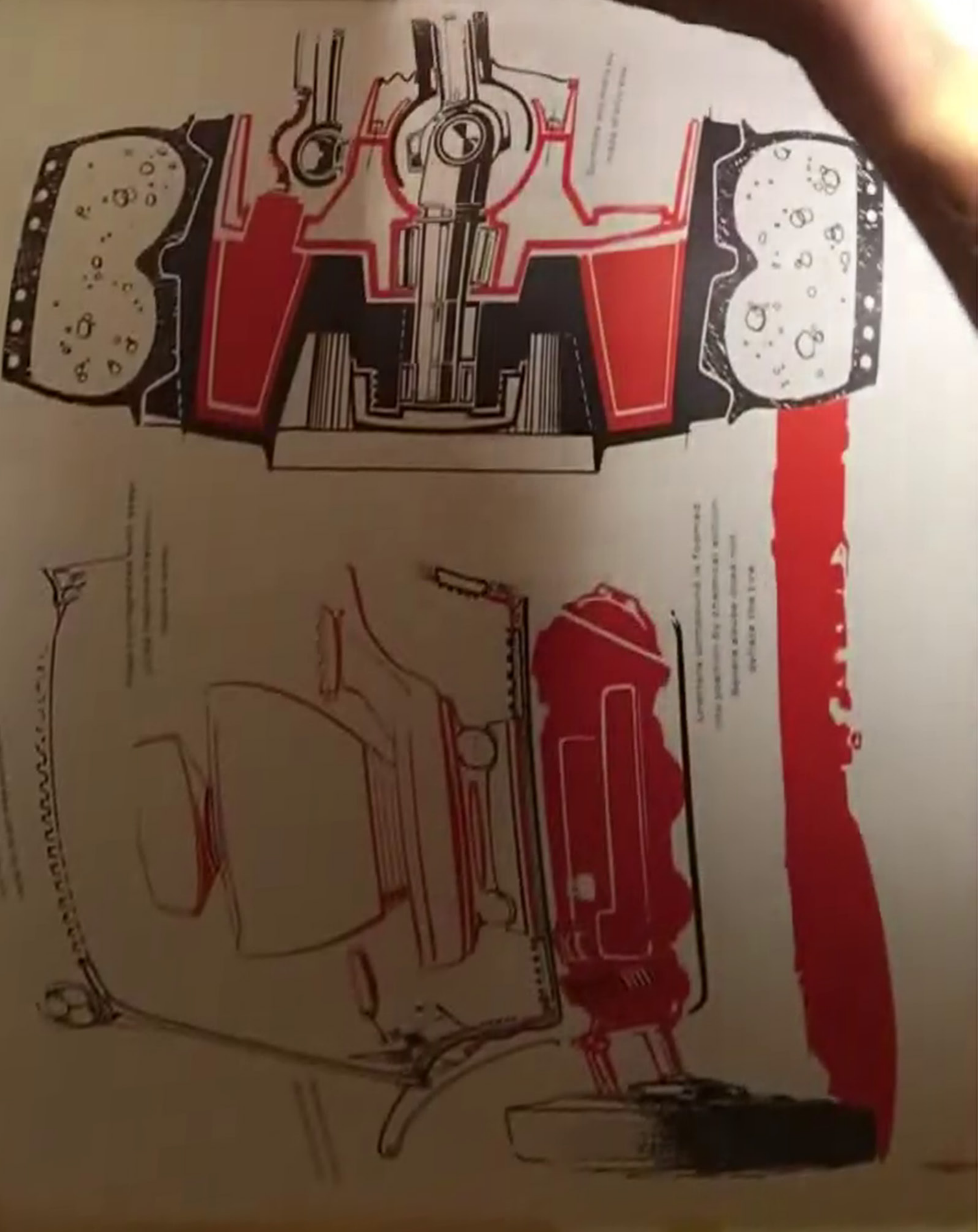


Cargo for a New World A-Building

The evolution in our social and mechanized living is advancing at such a rapid pace that it will be only a short time before areas now believed beyond our reach will be colonized.

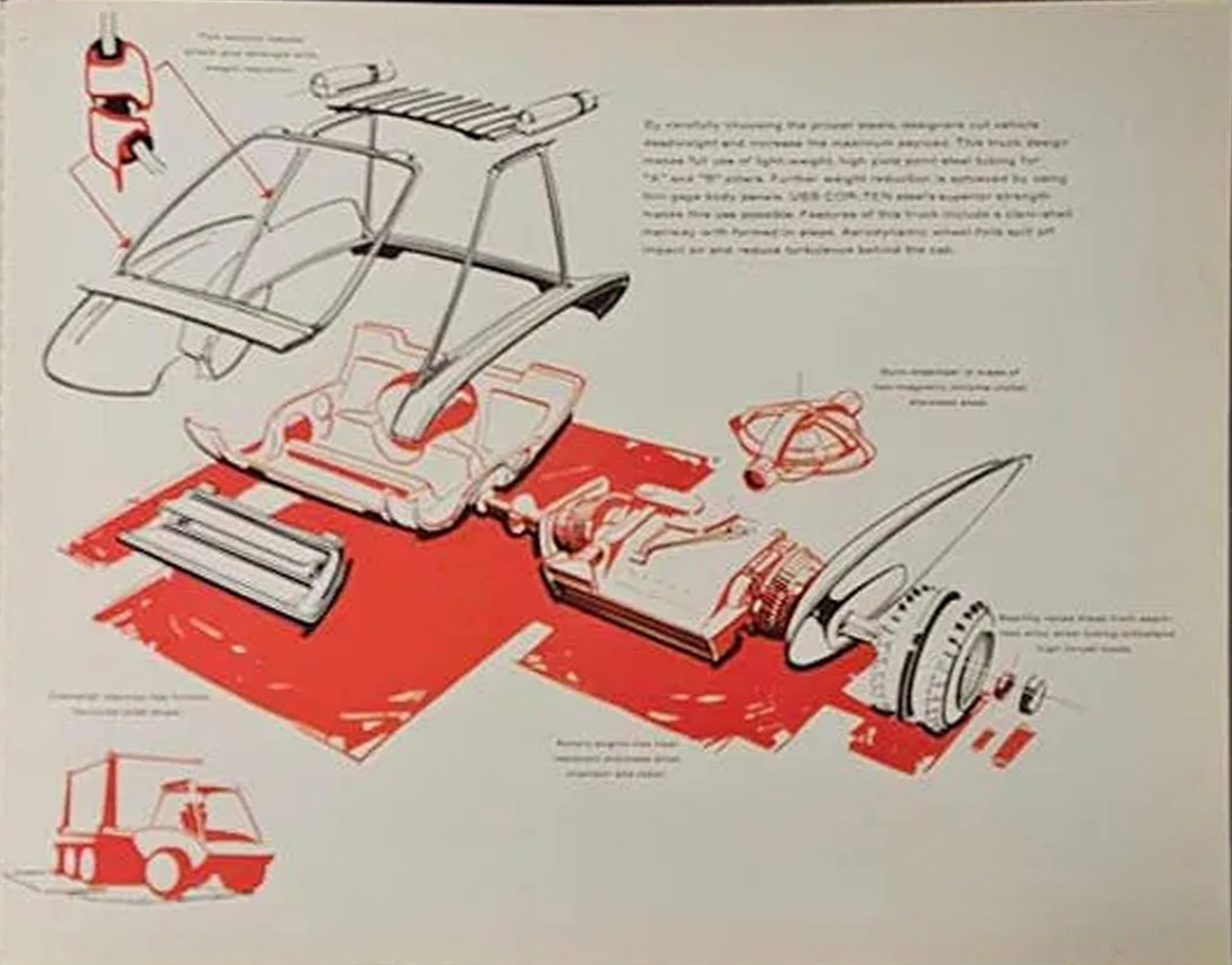
In such an area, industrial acids, in capsule tanks of stainless steel, are being delivered by this husky, self-loading flat-bed carrier, built of strong, corrosion resistant USS COR-TEN steel.



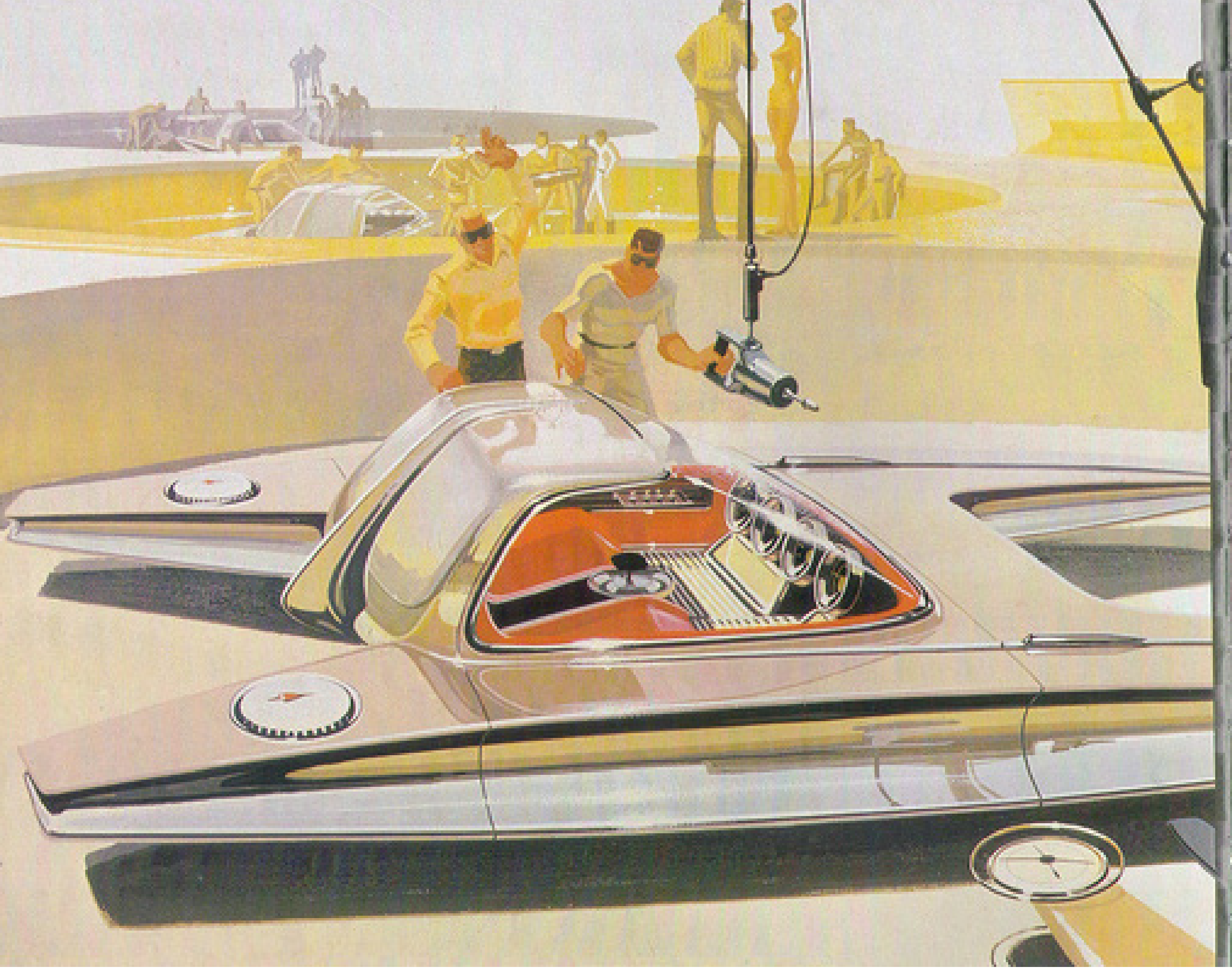


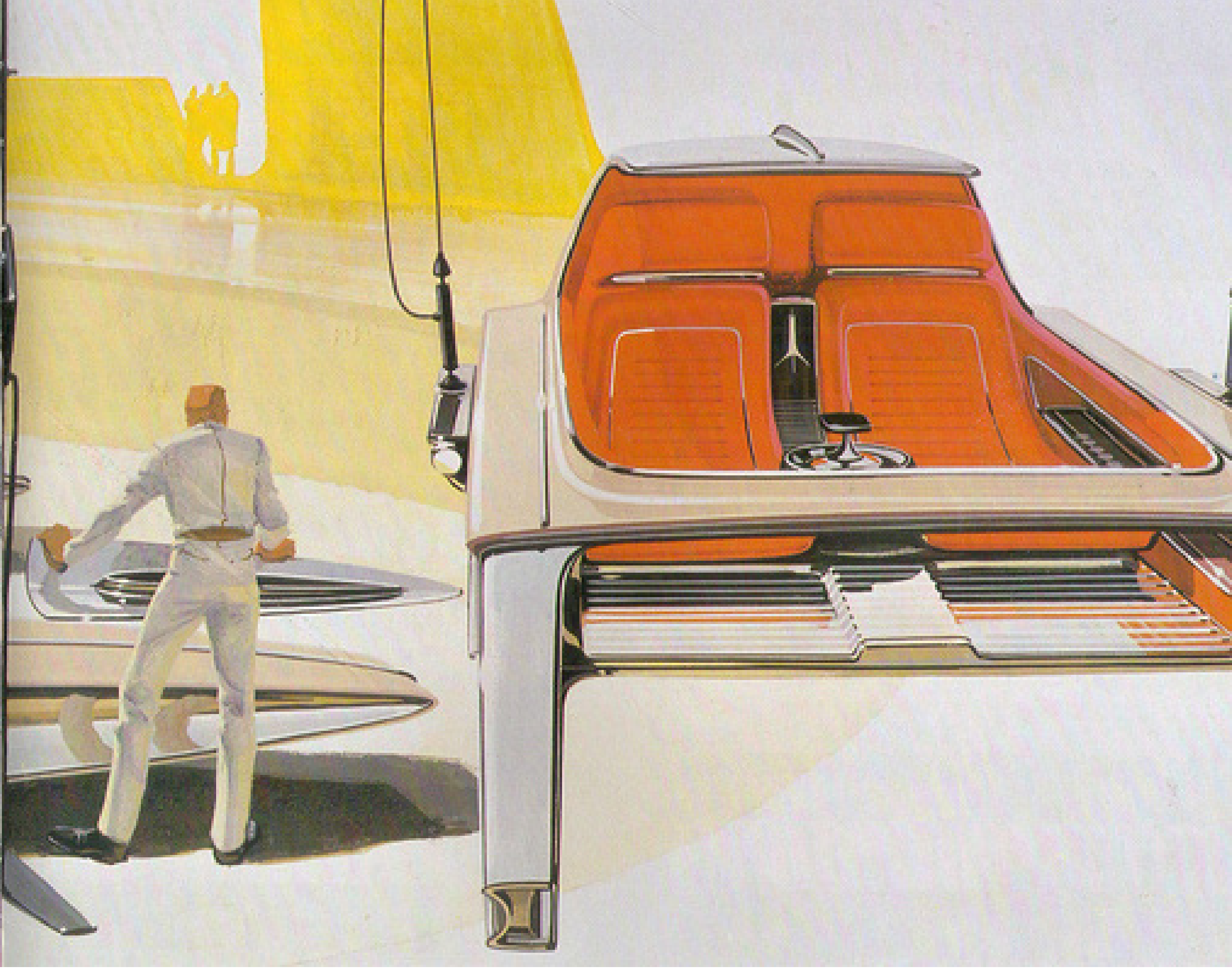


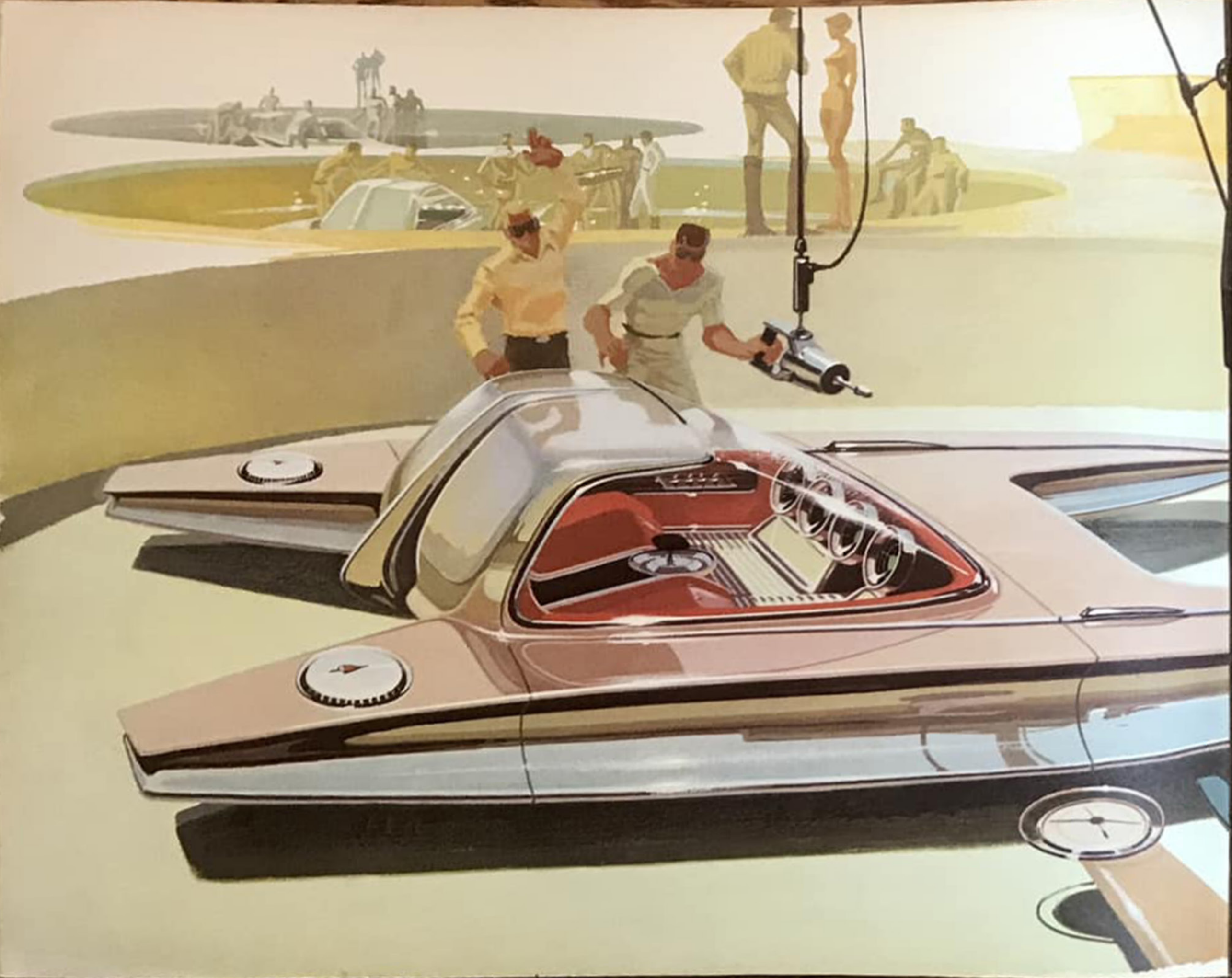


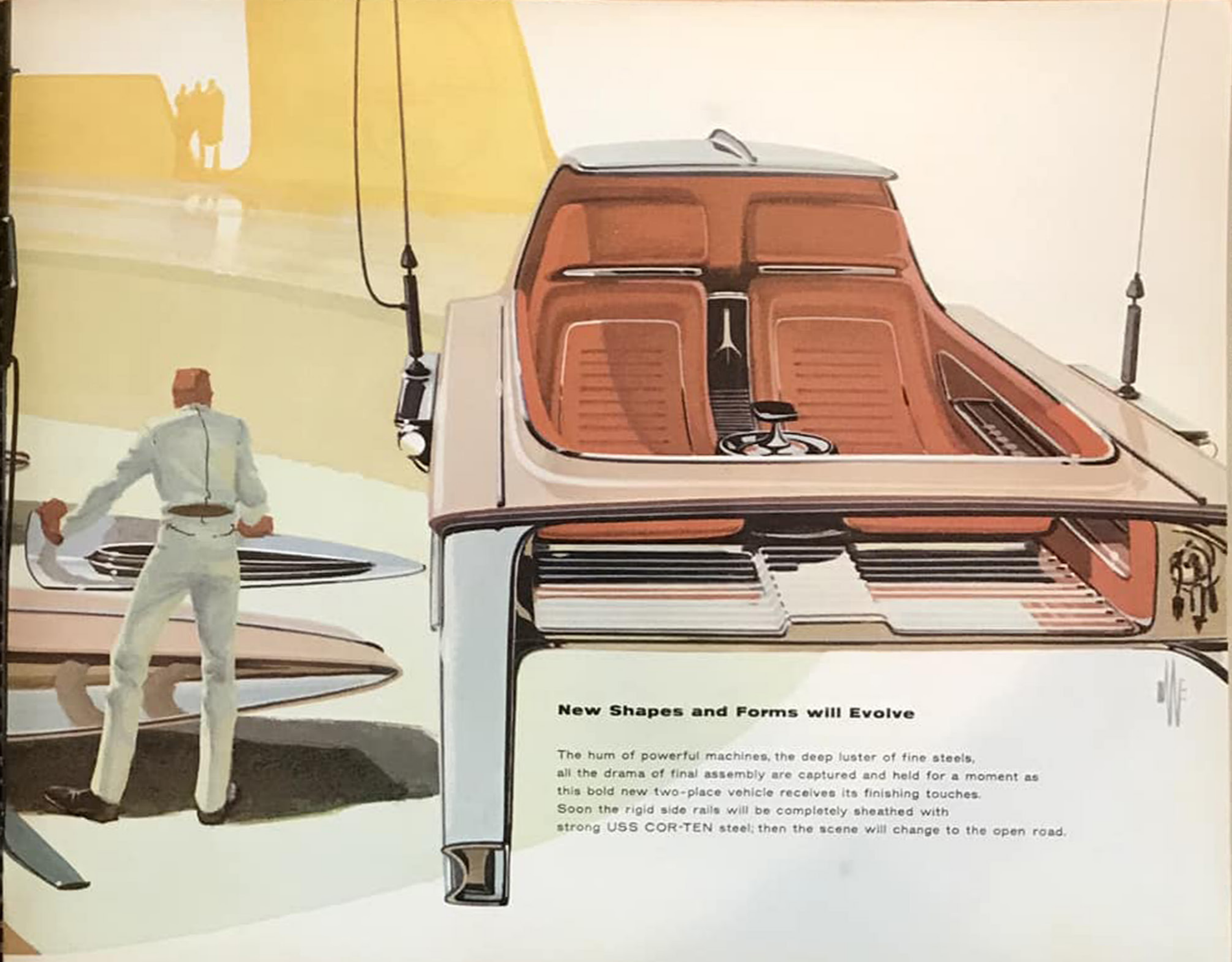


By carefully choosing the proper steels, designers cut vehicle deadweight and increase the maximum payload. This truck design makes full use of light-weight, high yield point steel tubing for "A" and "B" pillars. Further weight reduction is achieved by using thin gage body panels. USS COR-TEN steel's superior strength makes this use possible. Features of this truck include a clam-shell mainway with formed-in steps. Aerodynamic wheel lips split air impact on and reduce turbulence behind the cab.



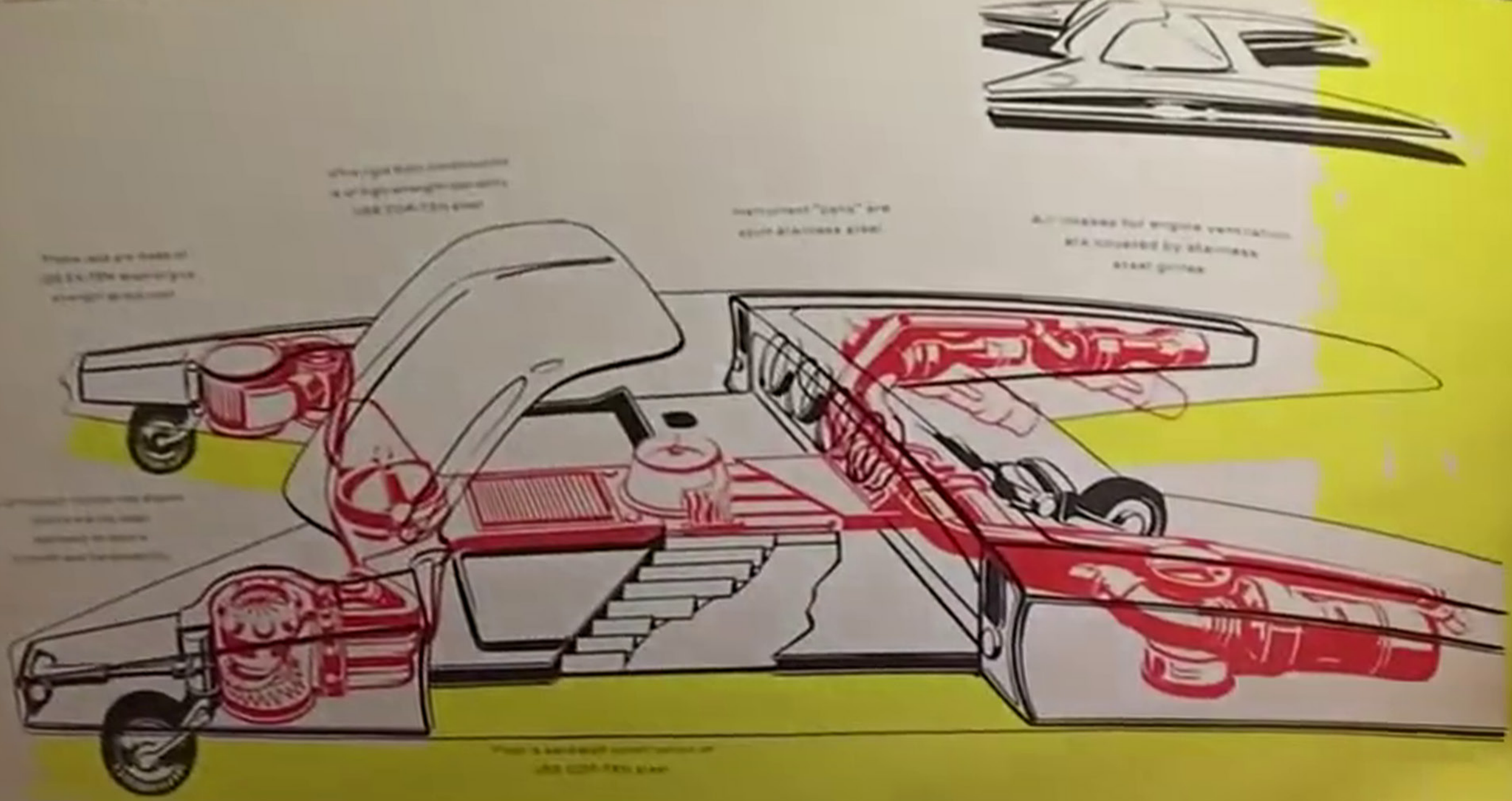






New Shapes and Forms will Evolve

The hum of powerful machines, the deep luster of fine steels,
all the drama of final assembly are captured and held for a moment as
this bold new two-place vehicle receives its finishing touches.
Soon the rigid side rails will be completely sheathed with
strong USS COR-TEN steel; then the scene will change to the open road.

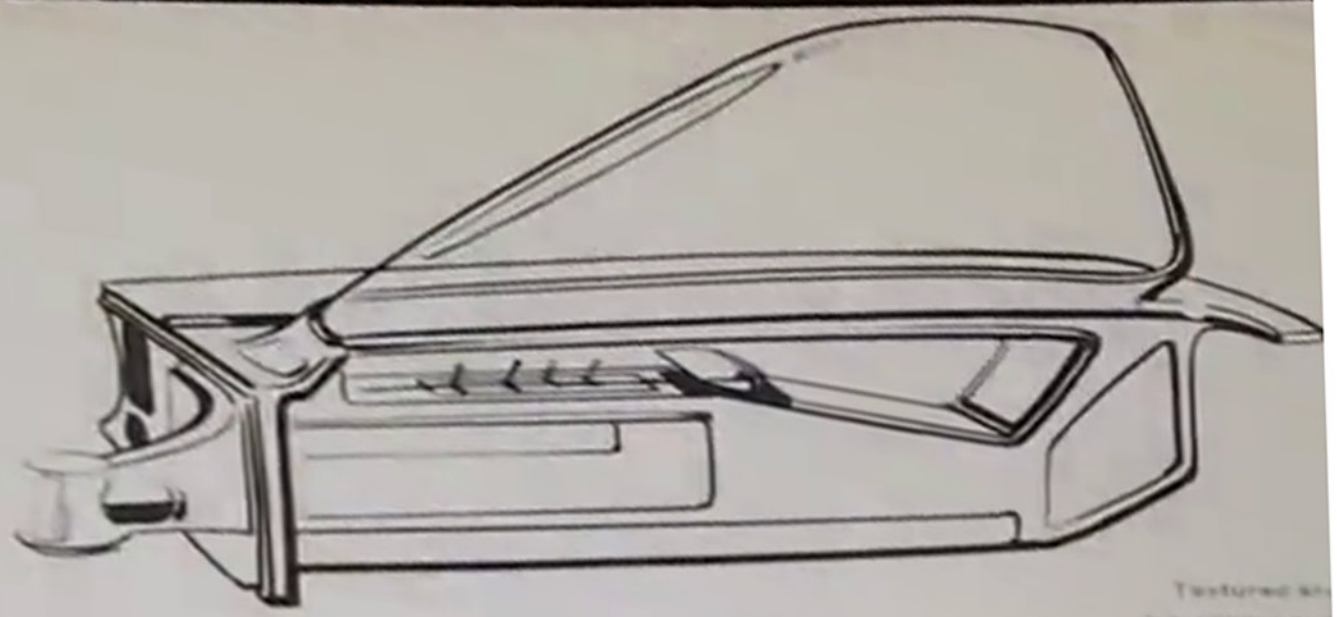


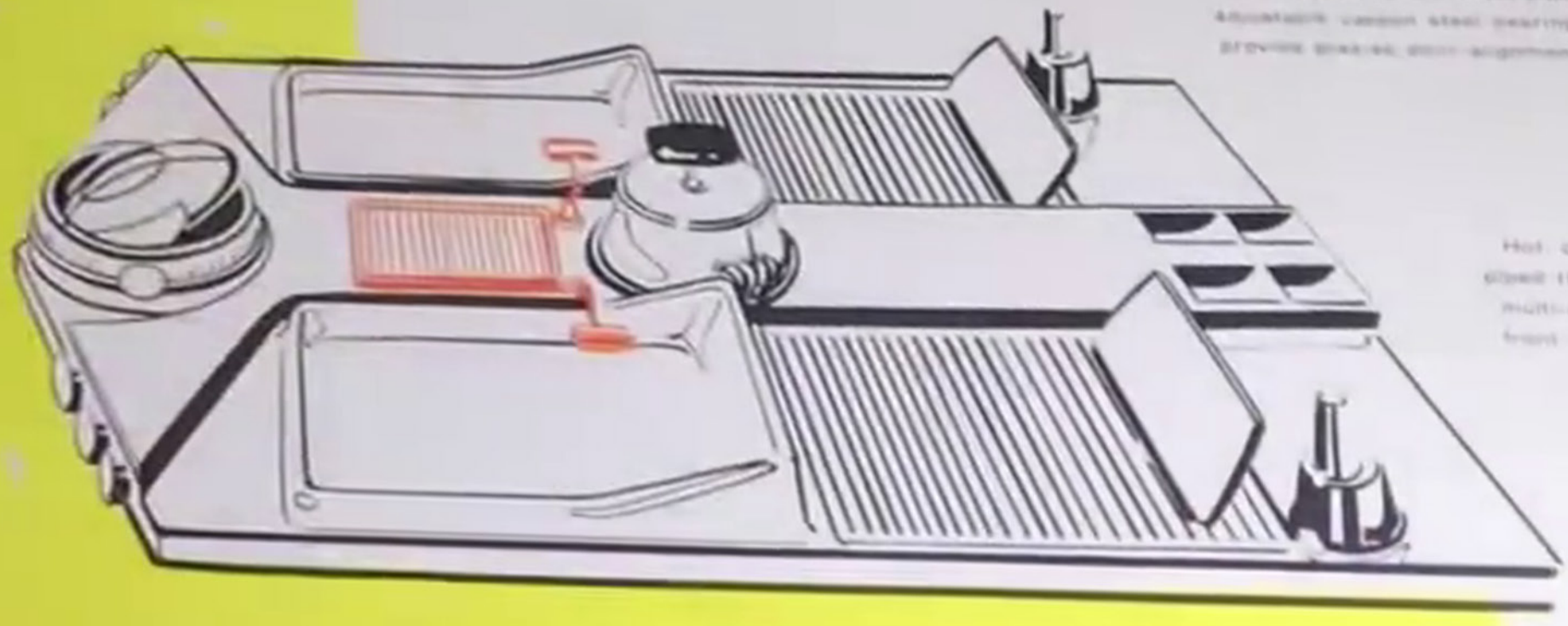
The correct durable lightweight right body construction. Only USS COR-TEN steel with its high yield point and resistance to atmospheric corrosion measures up to the designer's need for lightweight rugged construction.

Economic steel too, plays a major role in this interesting vehicle. Stainless steel is used in forward grilles where impact or pressure demands a material capable of resisting severe pressure deformation. The remedy: a wire stainless steel reinforced with a combination antenna-fin of formed USS COR-TEN steel.

USS COR-TEN steel answers the need for economy and strength in the frame rails.









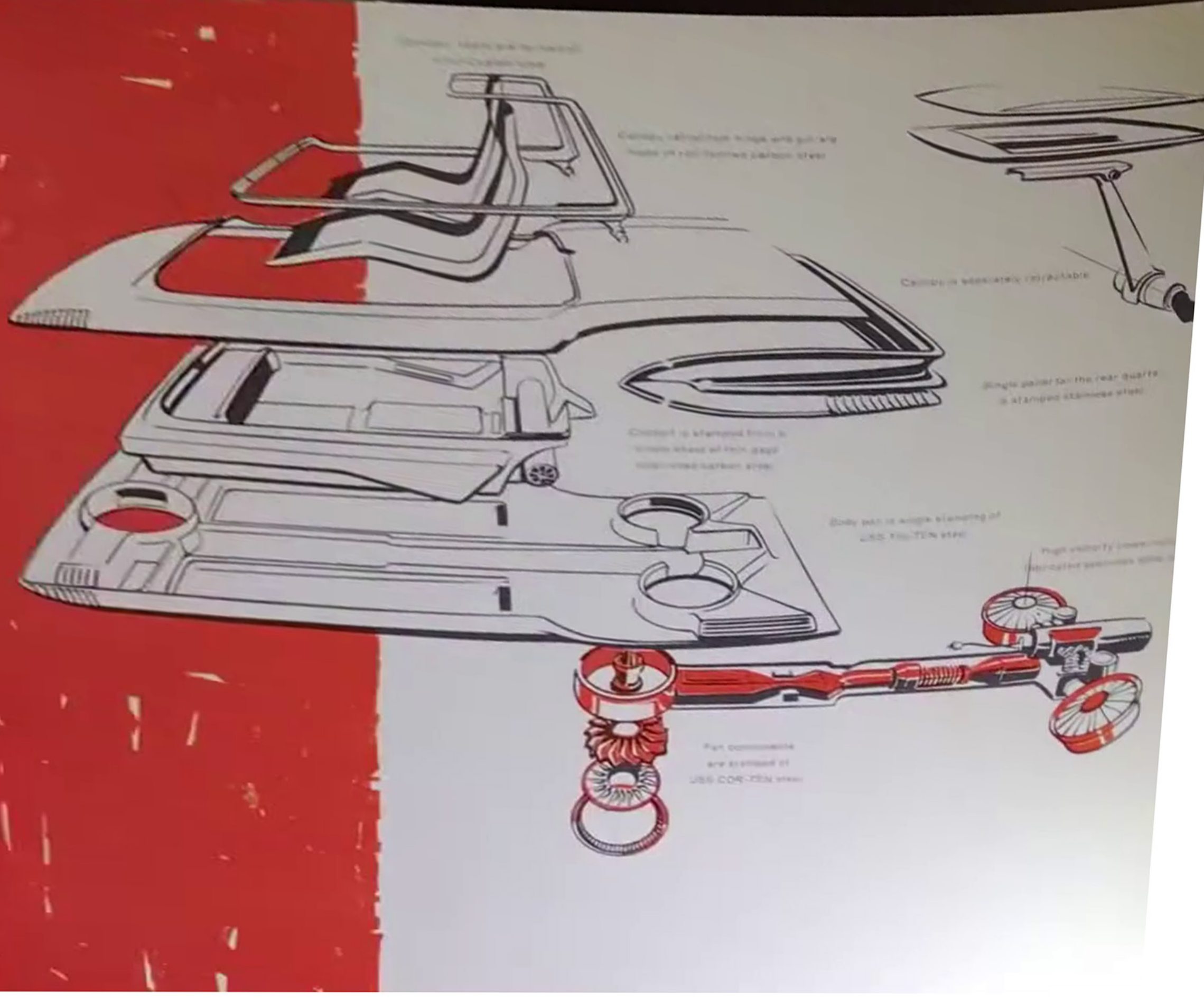


Ducted-Air Vehicle "Floats" on Steel Wings

In the automotive world of today, we are so accustomed to cars with wheels that roll on the road it becomes difficult to visualize any other type of car. But, the future will surely see wheelless cars which float a few feet above the surface.

This little ducted air low-level vehicle provides versatile transportation for two. Here steel reaches new heights as a building material. The greater strength and toughness of USS TRI-TEN, plus its weldability, combine to produce a vehicle with exceptional lightness and strength.



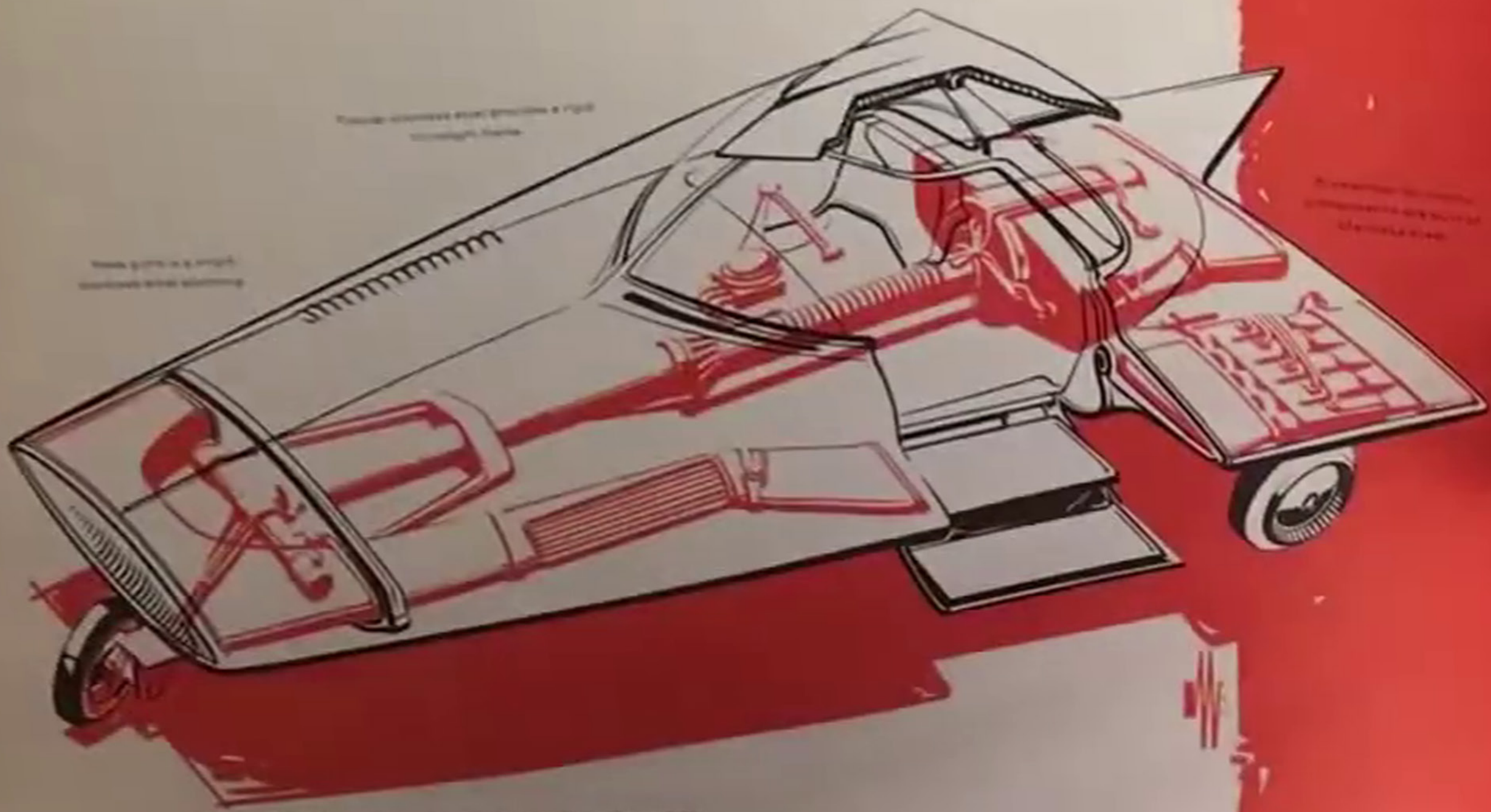




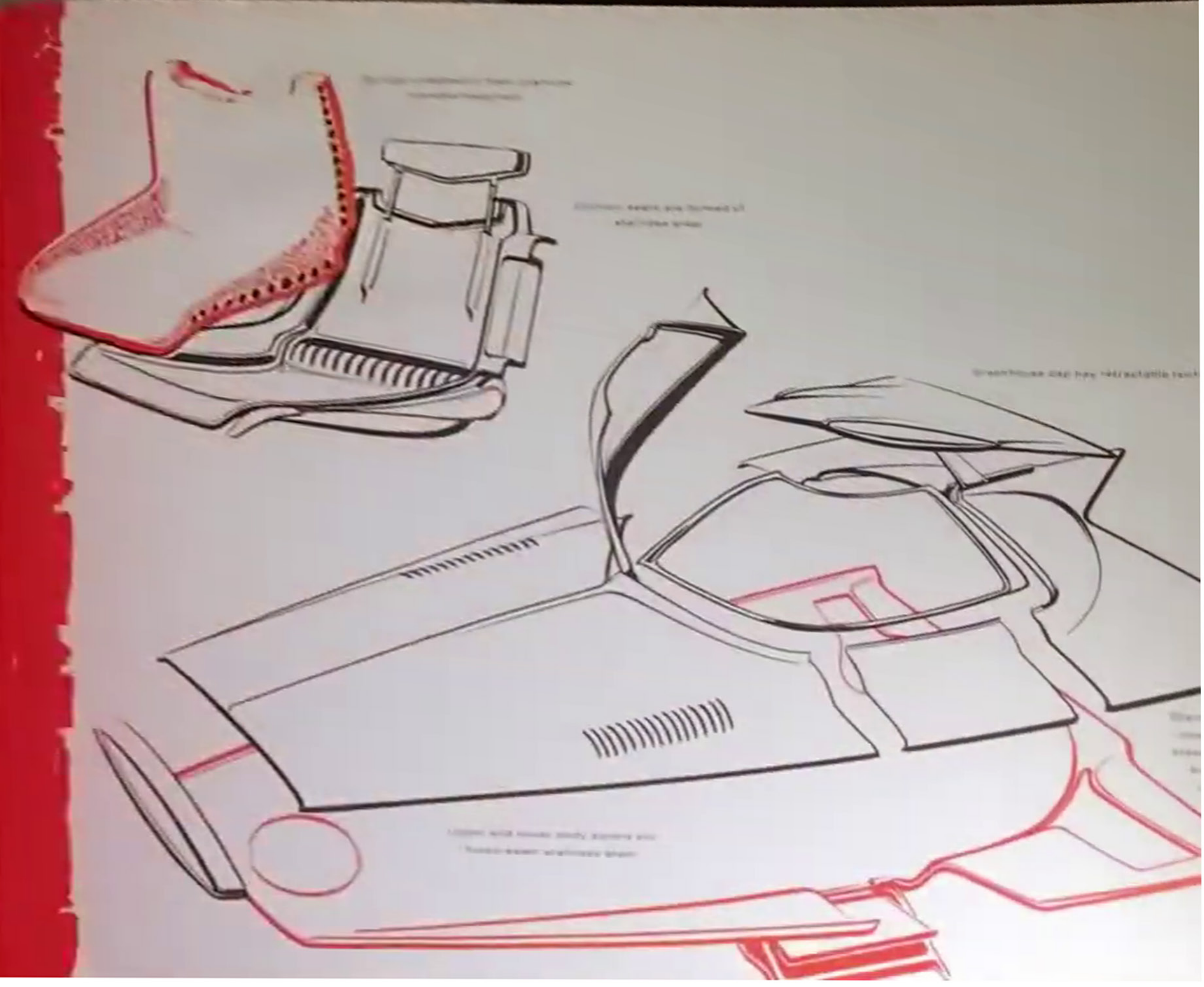
Designed to Last...in Stainless

Sleek two-passenger delta cars check in for inspection and re-energizing between trips. Their wide grilles characterize vehicles equipped with miniature jets—two five-chambered engines mounted in each wing. Phenomenal strength, plus high resistance to heat and corrosion, is obtained through stainless steel bodies and structural members.

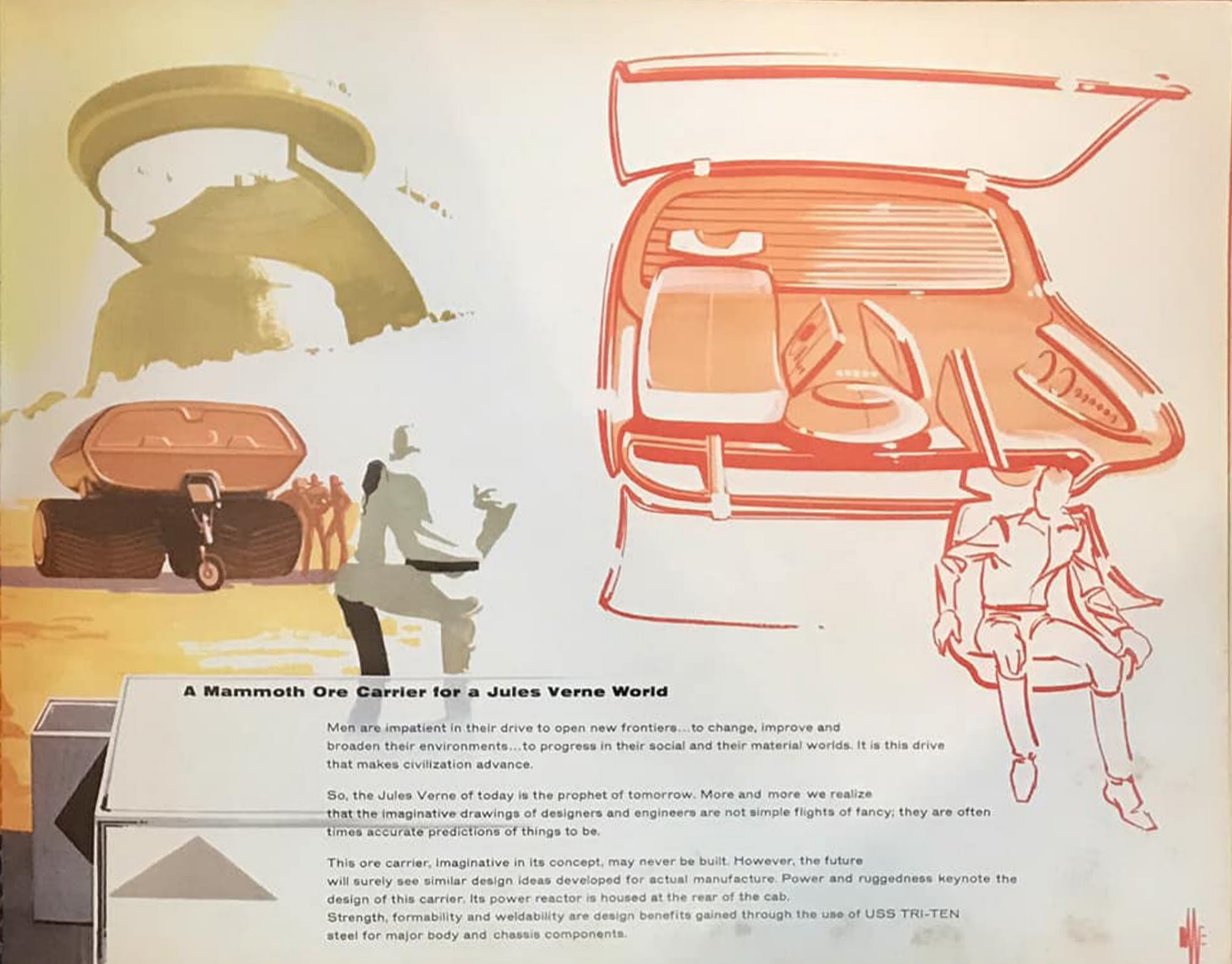




Function and fashion are combined in this sports car through the application of stainless steel. A high-strength stainless steel tube main spar supports the stainless steel bulkheads and doubles as a housing for the drive shaft and steering mechanism. The forward and side grilles are stainless steel castings, virtually impervious to corrosion.
Body panels are corrosion resistant stainless steel with fixed seams to provide an outer skin of exceptional rigidity. The aerodynamic design of the greenhouse cab makes retraction practical at cruising speeds.
Seat frames are formed of stainless steel seamless tubing and fitted with wire coil springs reinforced in foam cushions.





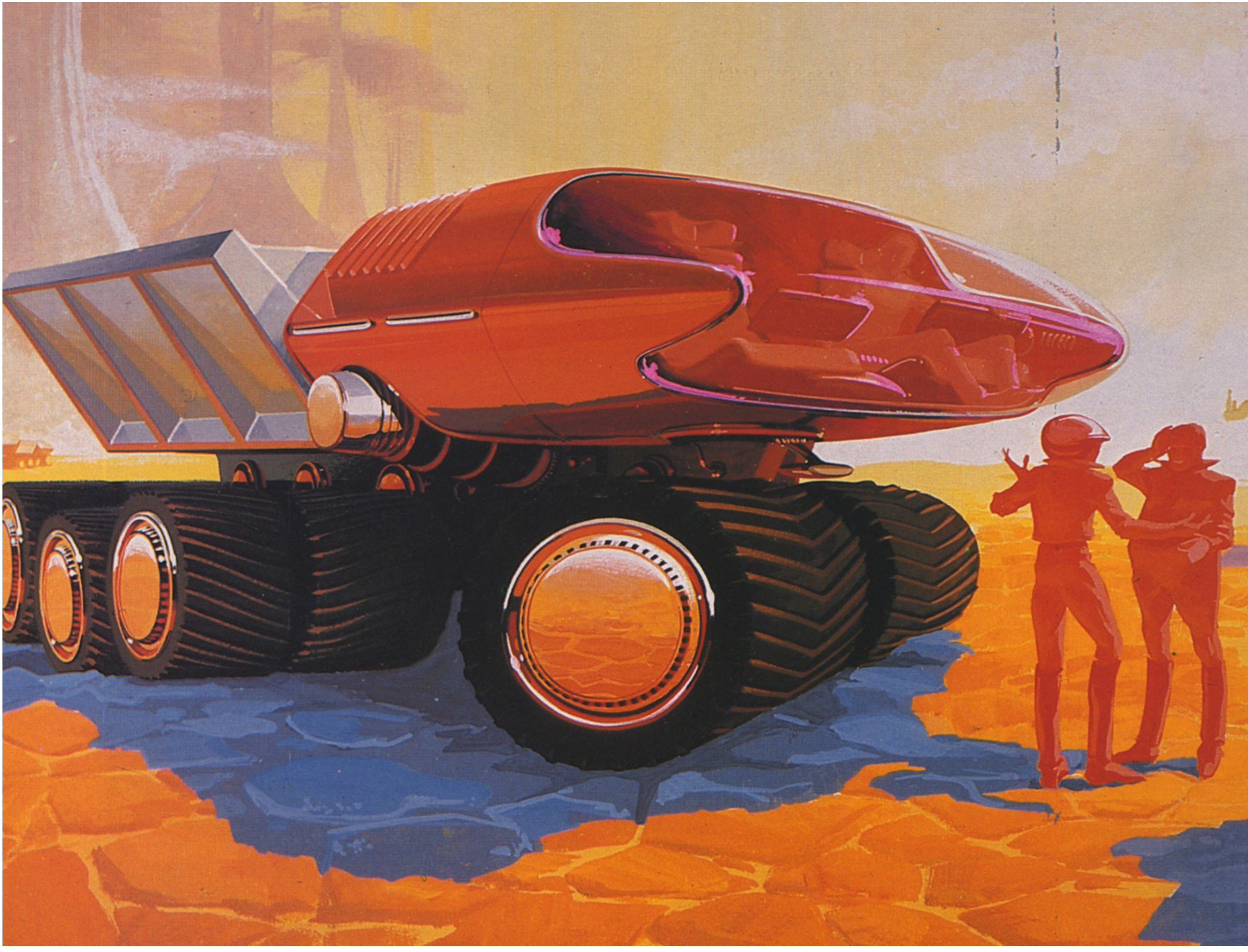


A Mammoth Ore Carrier for a Jules Verne World

Men are impatient in their drive to open new frontiers...to change, improve and broaden their environments...to progress in their social and their material worlds. It is this drive that makes civilization advance.

So, the Jules Verne of today is the prophet of tomorrow. More and more we realize that the imaginative drawings of designers and engineers are not simple flights of fancy; they are often times accurate predictions of things to be.

This ore carrier, imaginative in its concept, may never be built. However, the future will surely see similar design ideas developed for actual manufacture. Power and ruggedness keynote the design of this carrier. Its power reactor is housed at the rear of the cab. Strength, formability and weldability are design benefits gained through the use of USS TRI-TEN steel for major body and chassis components.









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Single beam frame is fabricated from USS "T-1" steel.

Servo controls in cab base give instant wheel loading and steering control.

Cradle for power unit telescopes for power source recharging.

Forged alloy steel axles have integral mirrors.



The spine of this ore carrier is fabricated from USS "T-1" steel. The power unit cradle is designed to be an integral part of the single beam frame. Individual motors power each wheel, giving tremendous traction and permitting a high degree of maneuverability. Forged and splined alloy steel axles shoulder the mighty loads with fatigue-free ease.

The electronic brain for this behemoth is forward mounted under the cab.

Economical USS EX-TEN steel forms the cab's tough skin, while the strength and toughness of USS "T-1" steel give the side-dump body the stamina to take it, again and again.

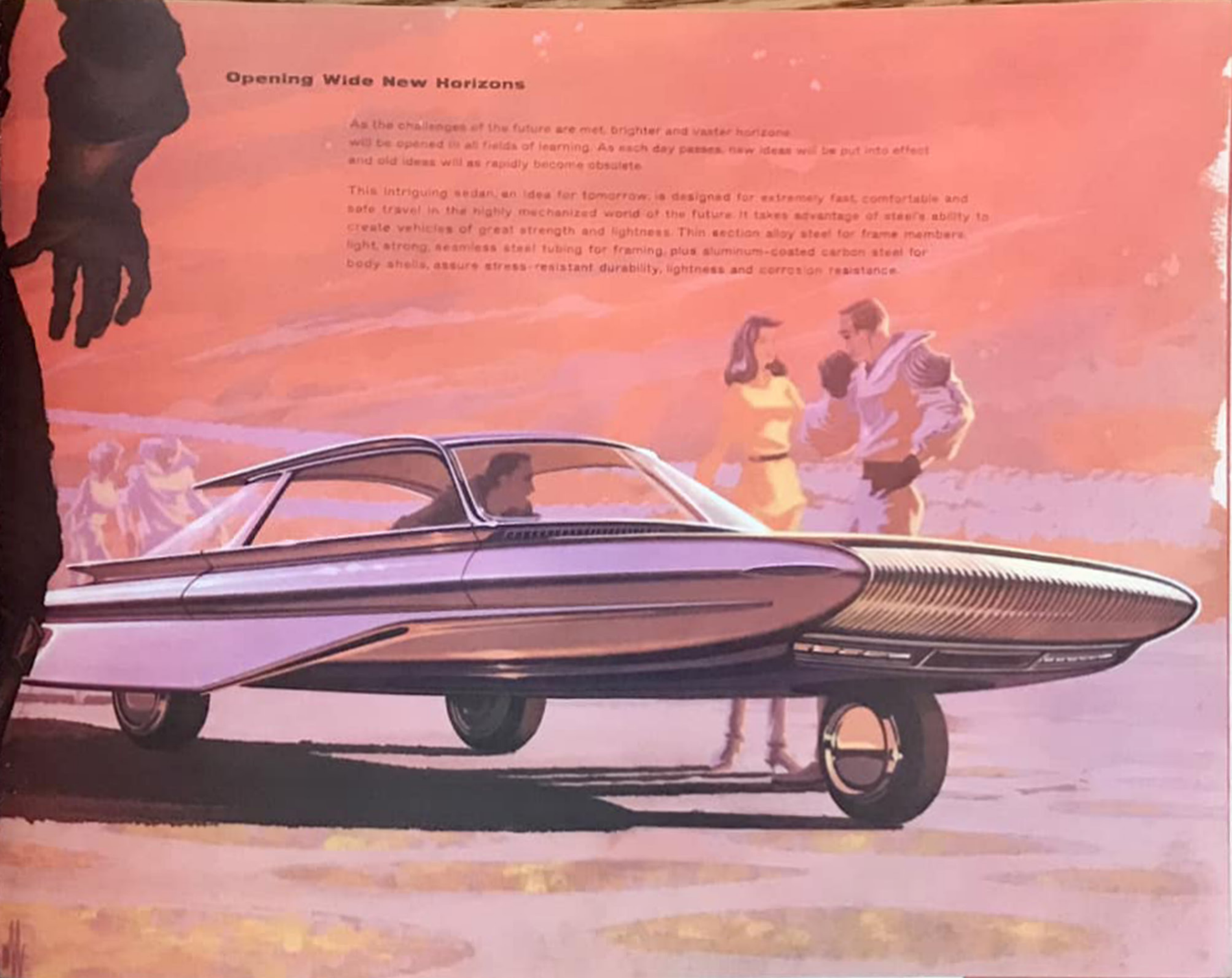




Opening Wide New Horizons

As the challenges of the future are met, brighter and vaster horizons will be opened in all fields of learning. As each day passes, new ideas will be put into effect and old ideas will as rapidly become obsolete.

This intriguing sedan, an idea for tomorrow, is designed for extremely fast, comfortable and safe travel in the highly mechanized world of the future. It takes advantage of steel's ability to create vehicles of great strength and lightness. Thin section alloy steel for frame members, light, strong, seamless steel tubing for framing, plus aluminum-coated carbon steel for body shells, assure stress-resistant durability, lightness and corrosion resistance.



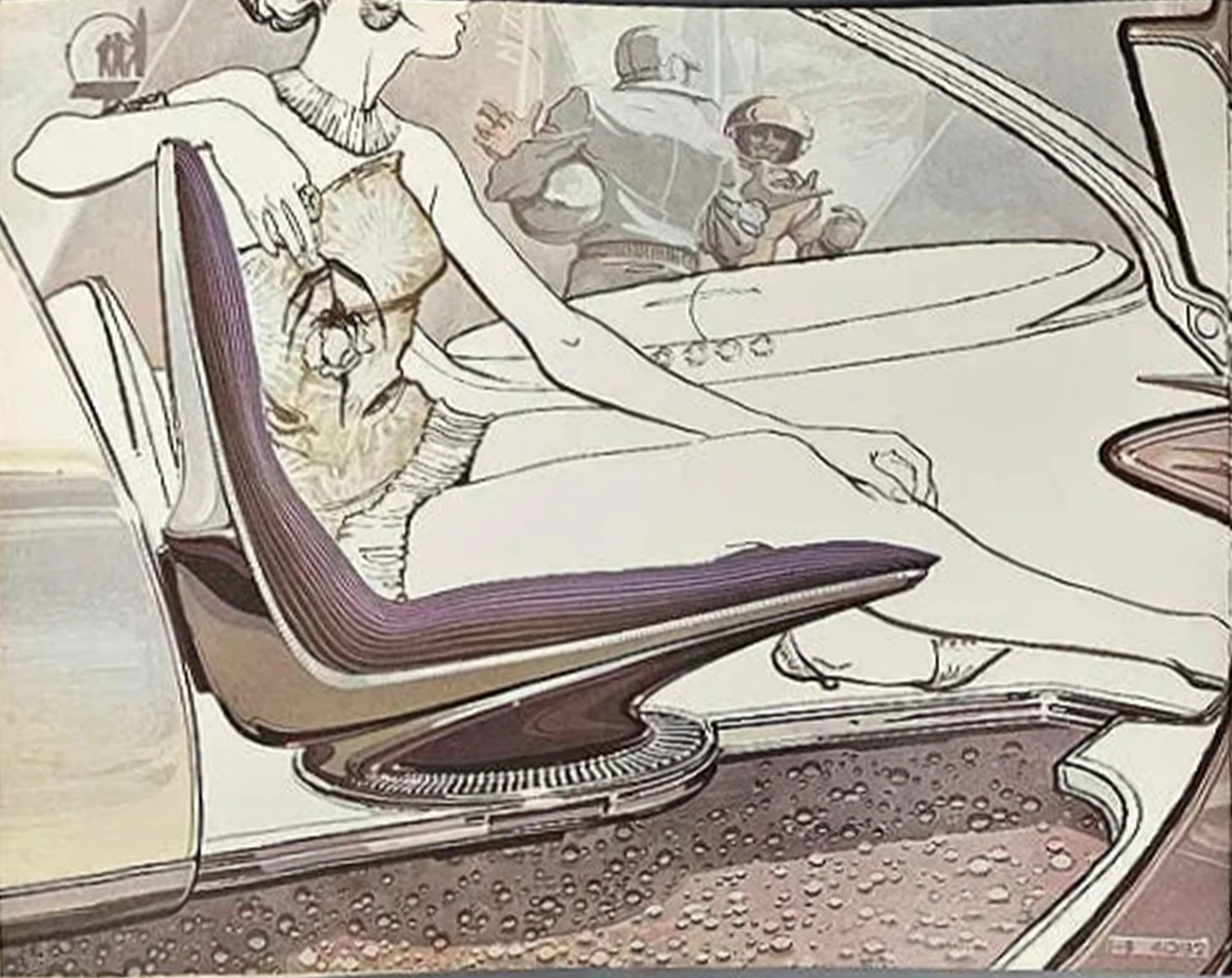
Beauty and Durability Etched in Steel

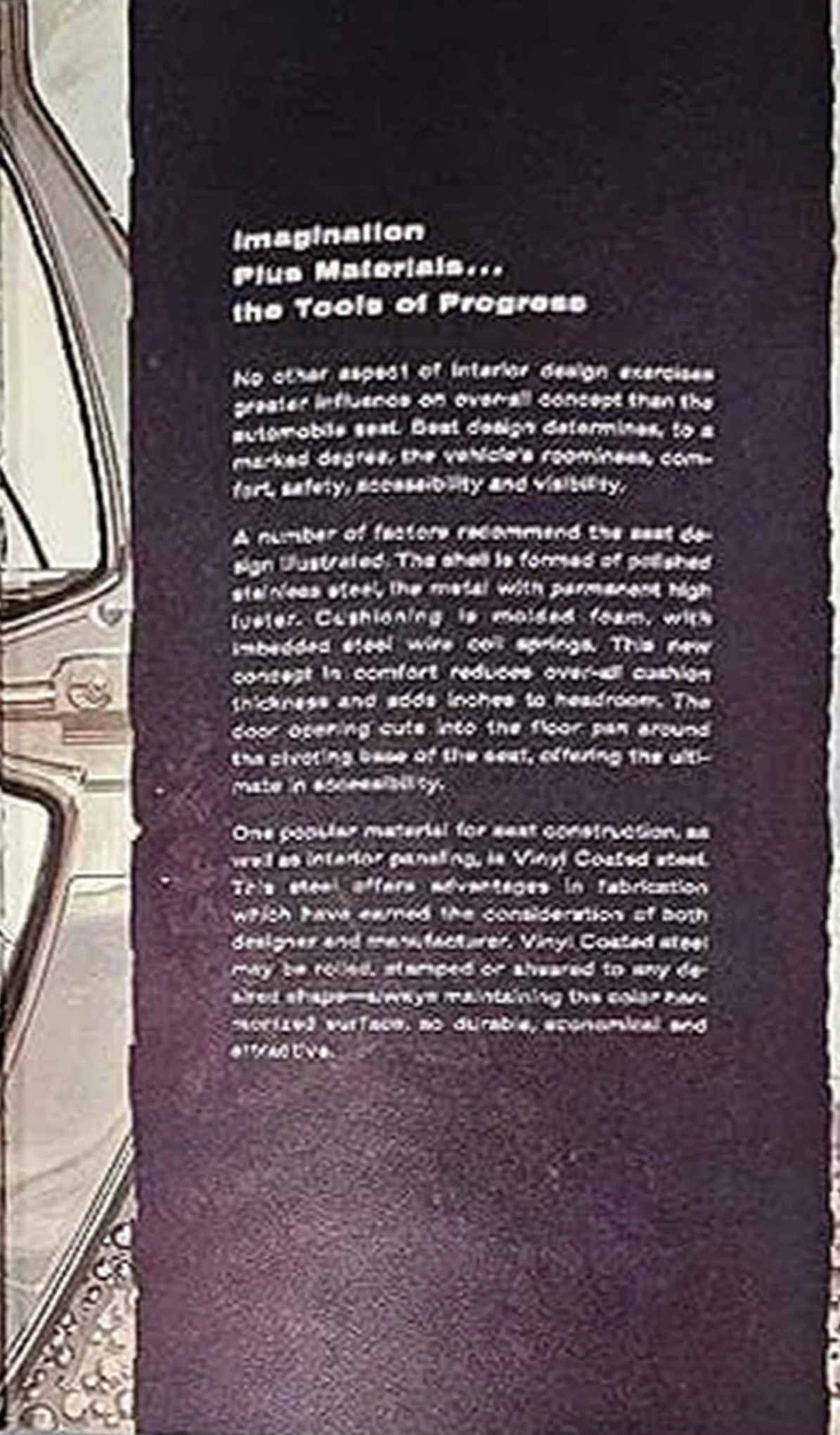
Advances in education and civilization bring greater increase in aesthetic appreciation. Tomorrow's family car will meet new demands for beauty and still fulfill the increased demands which advanced technology and faster travel will make upon its engineering and its design.

Rocker panels, door sills and door skirts of this future car pose no problems of corrosion. Made of galvanized steel, they meet exacting standards for corrosion resistance and attractive appearance.

Of interest in this little car is the woven steel wire door panel which conceals the car's radio and heater. Further, the use of soft, supple, woven steel fabric for the cushion facing solves another major problem—upholstery wear. A perforated stainless steel grille, matching the body molding, conceals the brake cooling air intake. A large, pad-type combination brake and accelerator pedal of fluted stainless steel gives instant, effortless control.





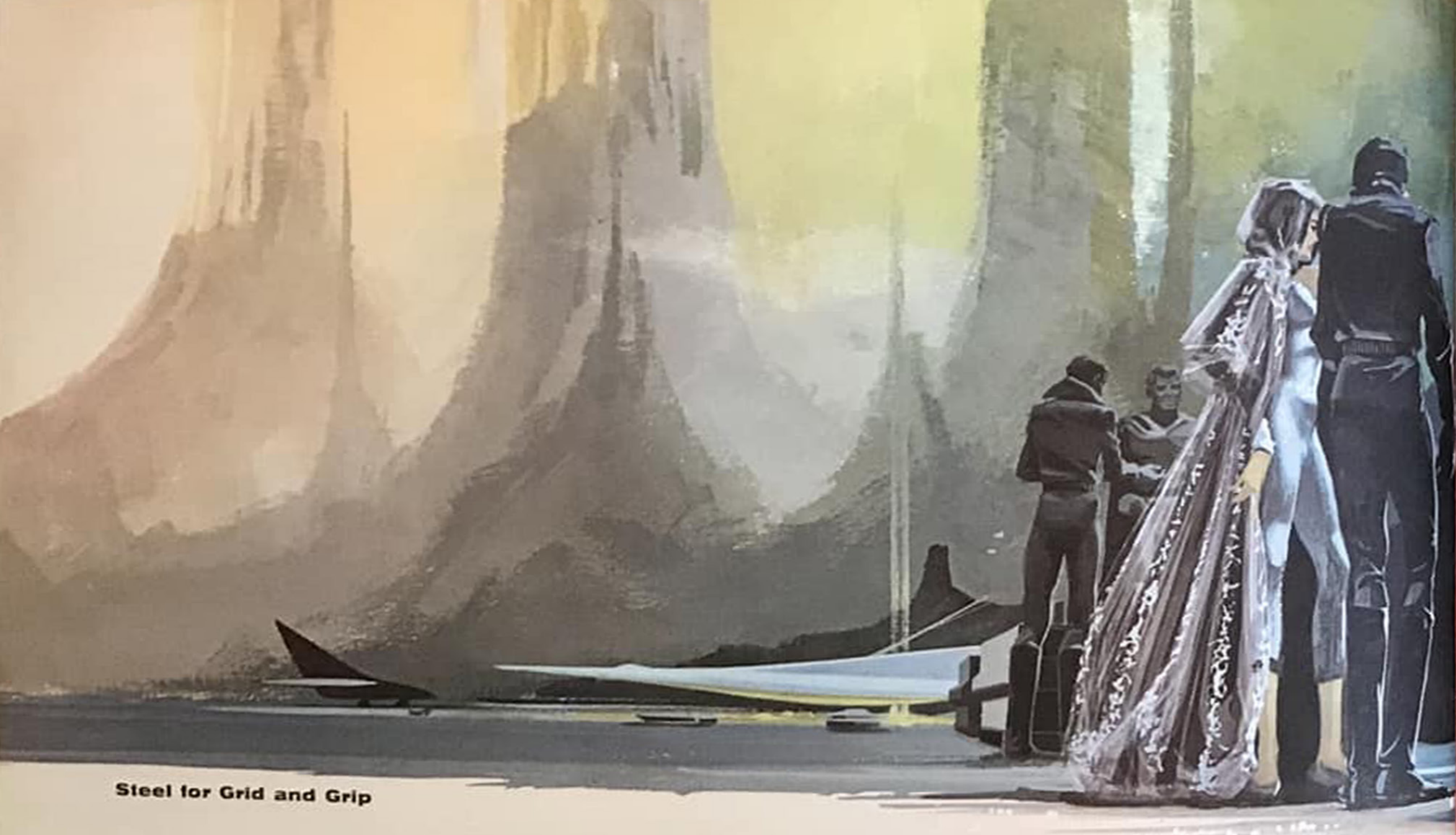


Imagination Plus Materials... the Tools of Progress

No other aspect of interior design exercises greater influence on overall concept than the automobile seat. Seat design determines, to a marked degree, the vehicle's roominess, comfort, safety, accessibility and visibility.

A number of factors recommend the seat design illustrated. The shell is formed of polished stainless steel, the metal with permanent high luster. Cushioning is molded foam, with imbedded steel wire coil springs. This new concept in comfort reduces over-all cushion thickness and adds inches to headroom. The door opening cuts into the floor pan around the pivoting base of the seat, offering the ultimate in accessibility.

One popular material for seat construction, as well as interior panelling, is Vinyl Coated steel. This steel offers advantages in fabrication which have earned the consideration of both designer and manufacturer. Vinyl Coated steel may be rolled, stamped or sheared to any desired shape—always maintaining the color harmonized surface, so durable, economical and attractive.



Steel for Grid and Grip

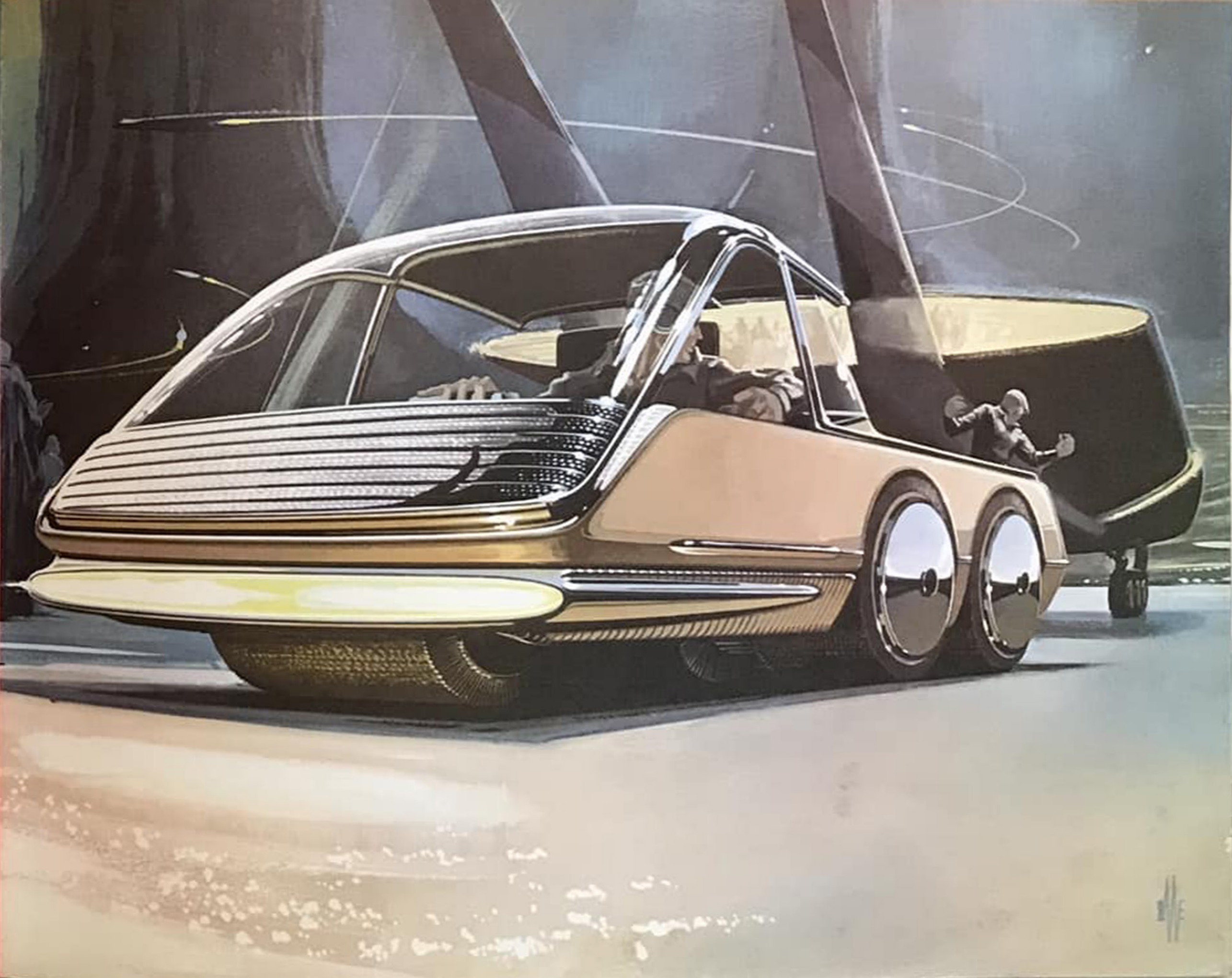
In the years to come, ground will be broken, highways leveled and runways smoothed in remote and untamed areas to make way for the rapid progress of civilization. Strange adventures—some now known only in science-fiction—will become realities, as man strives to conquer his environment and improve his welfare.

Progress comes, however, not from dreams but through serious, realistic approaches to problems and by difficult technological study and research.

This husky tug, conceived as a workhorse for heavy airport duty, is designed to double for highway express duty. Constant traction is delivered by steel wire wheels that have load deflection characteristics much like those of pneumatic tires. The drive application calls for high-tensile steel wire because it has excellent resistance to wear and will withstand high-operating temperatures.

Another feature of this vehicle is the grille-like front end, built of high-strength low-alloy steel tubing. Spanning full width for outstanding driver protection, these grille "bars" are fused at both ends to body "A" pillars. Louvers in the underbody provide fresh air for engine cooling.

A high intensity lightband is recessed in the plated, USS PAR-TEN steel impact bar. Stainless steel gives moldings and wheel discs a sparkle that is handsome and durable.

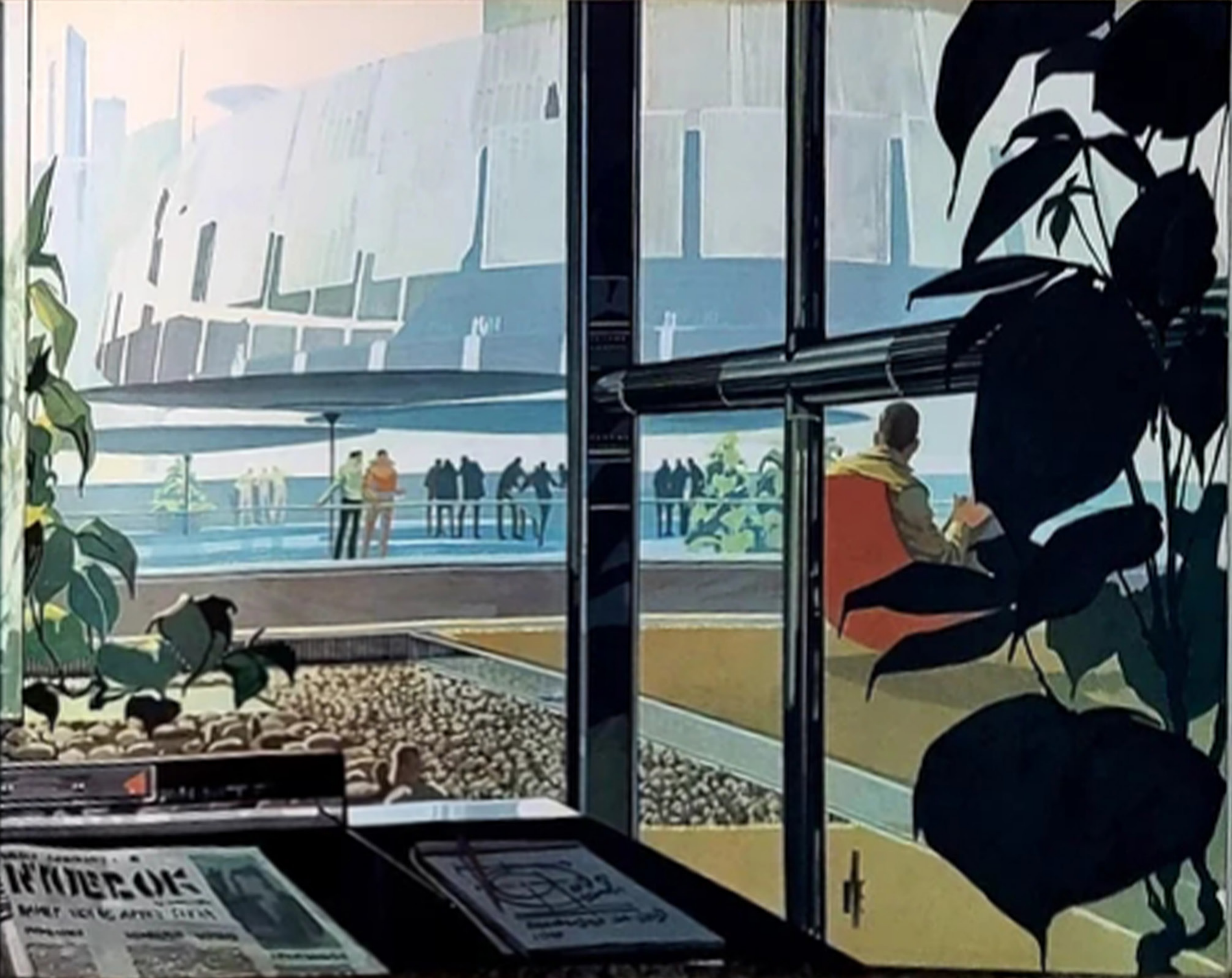


In Architectural Forms...
The Trend is Lighter and Brighter

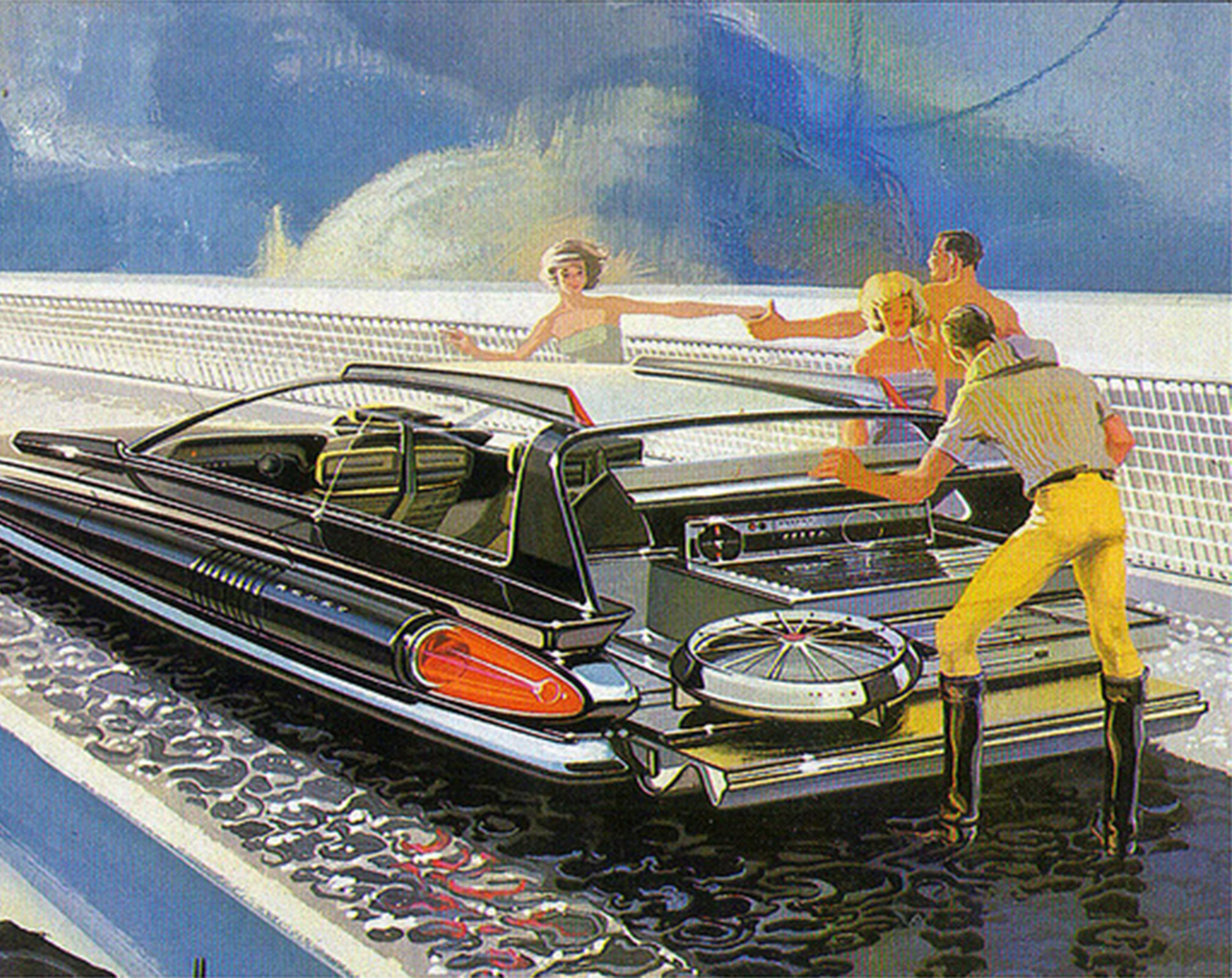
The mating of steel and sky creates a spectacular pattern of soaring lines and contrasting planes. Supporting this sky-high world are skeletons of structural steel with underpinnings of steel piles. From the computer cabinet, with its textured carbon steel strip decorating the face plate and the dramatically functional inter-com unit, to the prismatic solar heat absorption cells atop a nearby skyscraper, this world of tomorrow is truly a miracle of steel.

A panel of mesh stainless steel automatically traverses the window, casting welcome shade throughout the sun's course. Stainless-clad carbon steel adds luster and permanence to the tubular mullions. The promenade deck of an adjacent building is protected and decorated by panels of easily cleaned USS VITRENAMEL steel. Perforated stainless steel strip intakes begin the air filtering process by passing the air through finely woven wire cloth screens.

At the same time, the sensitively alert protector has capitalized on the decorative value of the muted shades, textures and shades of USS Heat Resisting Enamels. Finally, the ship's rough jacket of cork is held in an ideal bond with the canvas and bituminous roof surfaces.







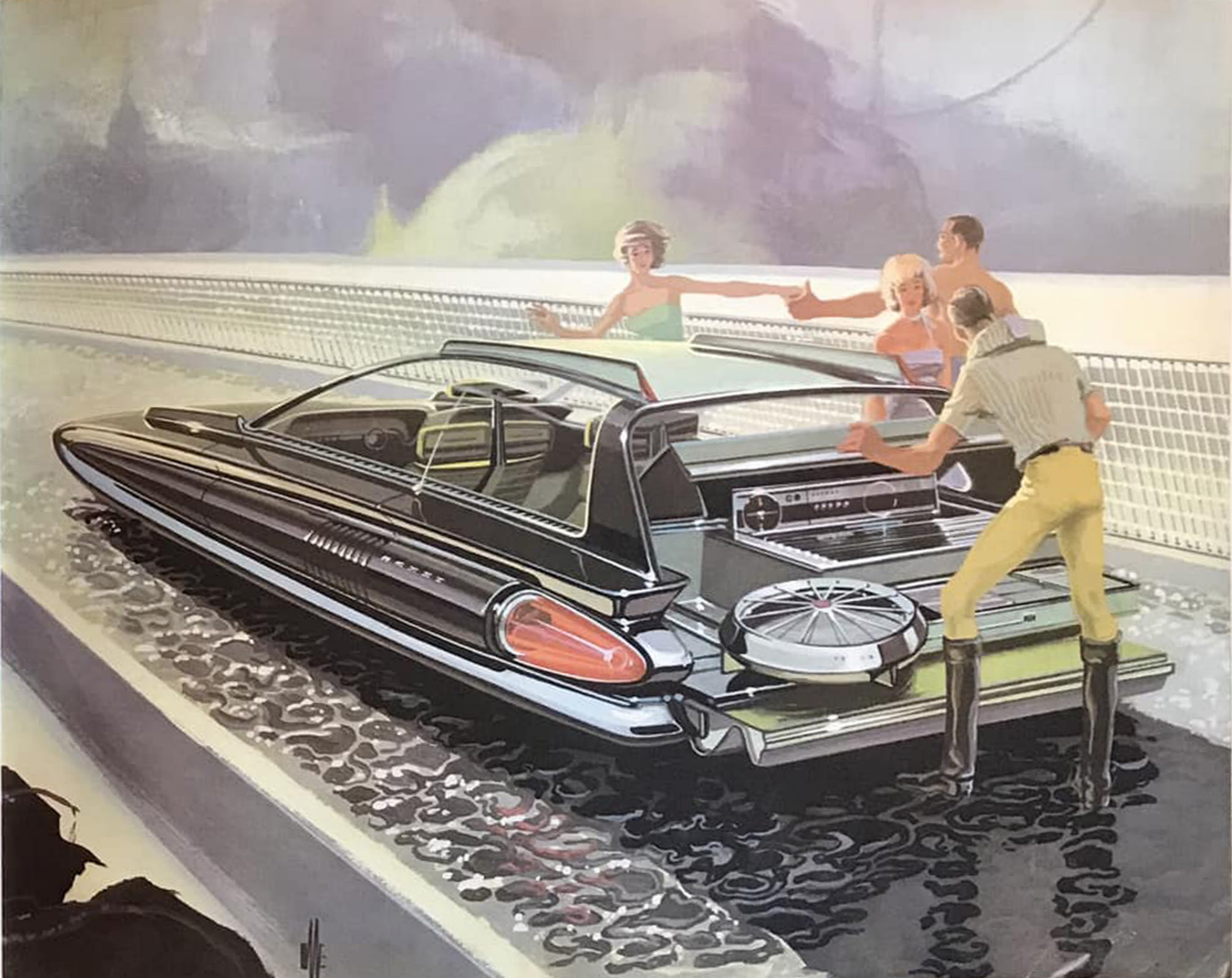
Pleasure is Made from Steel

Cross country and vacation travel in the future will be effortless and safe. This unique, compact car rides on an "automatic road"—a braided wire safety guide rail which produces directional impulses to keep the car on course without driver attention.

The designer calls this a "cook-out" car. The food conditioner is made from easy-to-form Vinyl Coated steel. A portable solar furnace quick-cooks the food at a touch of the mirror bright, stainless steel focus screen. Breakfast at Yellowstone Park and dinner in the Great Smokies are possible with this high speed pleasure car.

The gleaming chromed bumper of USS PAR-TEN steel makes driving safe and carefree when the car leaves the "automatic road" and manual driving becomes necessary.

Interior side panels, floor and seat backs are made colorful and durable with Vinyl Coated steel. In fact, steel, in its infinite combinations, makes possible the lightness, compactness, and strength which serve dual functions—pleasure and safety.

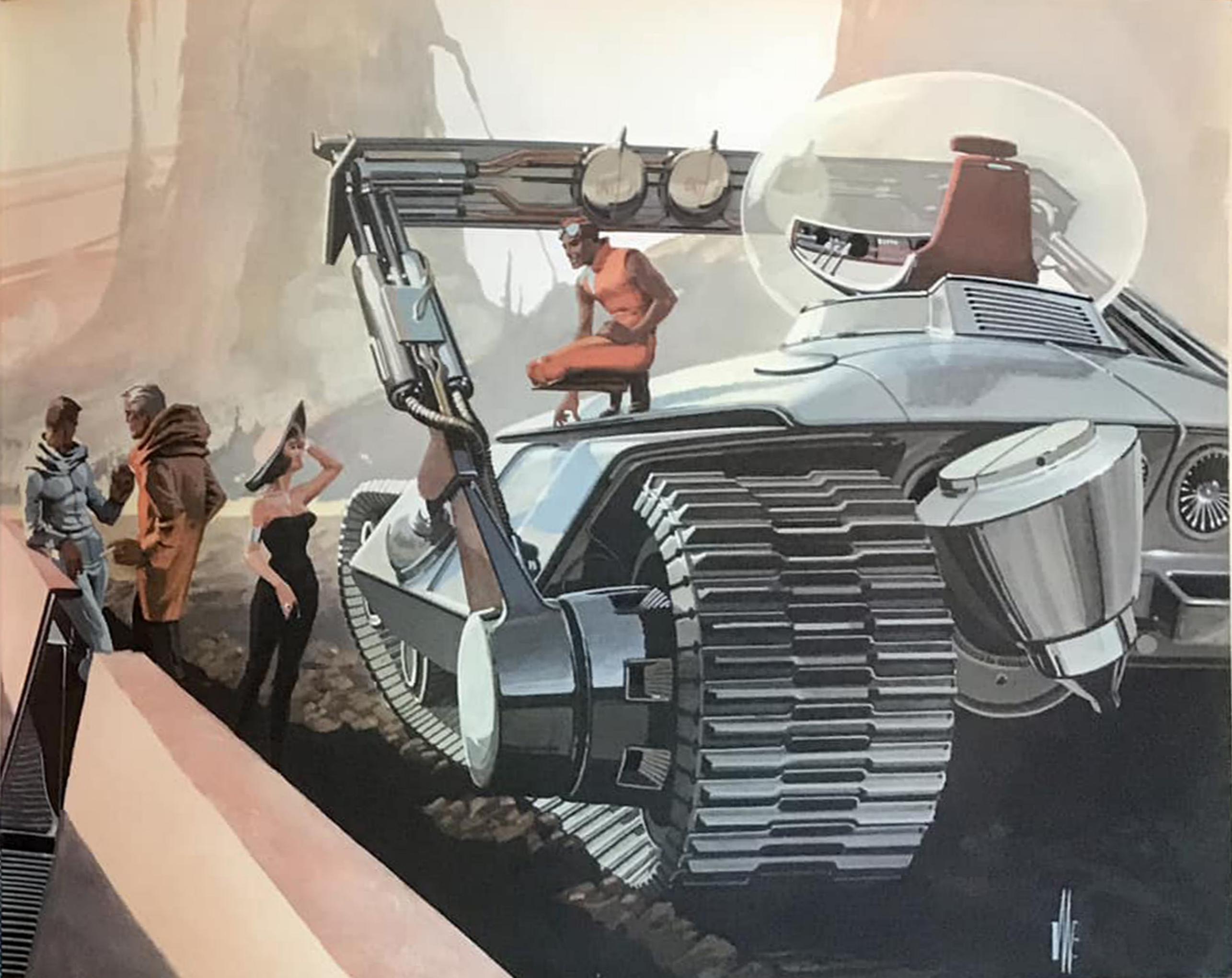


Steel's Most Important Characteristic...
"Fastenability"

Whether they are for the soaring swallow of the highway or for the heavy pachyderm of the farm, the requirements of intricate and unusual construction are met by steel. No other single building material offers man so many design answers as steel does. A steel having certain basic qualities can be joined easily to other steels with completely different qualities to form an integrated design. This joining can be done by means of bolts, screws, rivets, pins, bonding or welding.

No other material has this unusual "fastenability." Certain other materials may fatigue or fail at the joints. It is this "fastenability" characteristic of steel which has given designers greater freedom in creating products for the home, the road, the farm or for industry.

Limitless numbers of steel parts, among them hinges, track plates, drive shafts and steering linkage for on or off the road vehicles, owe their strength to steel and its "fastenability."



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Fabrics of Steel for Tomorrow

A cloth top of steel? Yes—and what is more, it will not leak, stain, rust or stretch! The rigidized fabric used for the top of this sportscar is made from gossamer-thin stainless steel wire woven into cloth. Steel cloth functions in every way like conventional fabric, yet it has the indestructibility of steel plus exciting new brightness.

This steel fabric roof boasts a retractable sky-view panel which gives passengers a more enjoyable, open-air ride in good weather, and which is air tight and leak proof in bad weather.

Another feature of this smart sportscar is the use of stainless steel cloth in the side bolsters of the seat cushions. This steel cloth adds interest in styling since it can be woven into a variety of different textures and patterns. And, too, the wear defying quality of the stainless steel fabric adds permanence to this sportscar's tailored interior decor.





Typical Properties of Martensitic-Ferritic USS Stainless Steels

USS GRADE:	USS 12M2	USS 12Mo, 12, 12Pb	USS 17	USS 27	USS 5	USS 53
A. I. S. I. TYPE NUMBER:	TYPE 405	TYPES 409, 410, 416	TYPE 430	TYPE 446	TYPE 501	TYPE 502
PHYSICAL PROPERTIES						
Density						
5.0 Cr to 7%	0.28	0.28	0.28	0.27	0.28	
Low Carbon Steel (Mild 0.02%C to 1.0%	0.87	0.87	0.87	0.95	1.0	
Specific Electrical Resistance at 68°F						
Microhms/Cm.³	60	57	60	67	40	
Microhms/In.³	23.6	22.4	23.6	26.4	15.7	
Low Carbon Steel=1.00	6.5	5.2	6.5	6.1	3.6	
Melting Range, °F	2700-2790	2700-2790	2600-2750	2900-2790	2700-2800	
Structure*	Ferritic	Martensitic	Ferritic	Ferritic	Martensitic	
Magnetic Permeability vs Annealed	Ferro-mag.	Ferro-mag.	Ferro-mag.	Ferro-mag.	Ferro-mag.	
Specific Heat						
Cal./°C/Gm. 20 to 100°C) OR						
Btu/°F/Lb. (32 to 212°F)	0.11	0.11	0.11	0.12	0.11	
Low Carbon Steel=1.00 (0 to 100°C)	1.0	1.0	1.0	1.0	1.0	
Thermal Conductivity						
Cal./Cm./Sec./°C/Cm., at 100°C	—	0.0595	0.0625	0.0500	0.0875	
Btu/Sq. ft./Hr./°F/In. at 212°F	—	173	181	145	254	
Low Carbon Steel=1.00 at 100°C	—	0.52	0.54	0.43	0.76	
Cal./Cm./Sec./°C/Cm., at 540°C	—	0.0688	0.0627	0.0543	0.0807	
Btu/Sq. ft./Hr./°F/In., at 932°F	—	199	182	169	234	
Coefficient of Thermal Expansion						
Per °F x 10⁻⁶ (32 to 212°F)	6.0	5.5	5.6	5.6	6.2	
Low Carbon Steel=1.00 (32 to 212°F)	0.91	0.83	0.85	0.85	0.94	
Per °F x 10⁻⁶ (32 to 932°F)	6.7	6.4	6.3	6.3	7.2	
MECHANICAL PROPERTIES AT ROOM TEMPERATURES	AN-NEALED	AN-NEALED	QUENCHED & DRAWN	AN-NEALED	COLD WORKED	AN-NEALED	COLD WORKED	AN-NEALED	QUENCHED & DRAWN**
Endurance (Fatigue) Limit (1,000 Lbs./Sq. In.)	—	30-50	40-100	35-50	—	30-55	—	—	—
Modulus of Elasticity (1,000 Lbs./Sq. In.)	29	29	29	29	29	29	29	29	29
Tensile Strength (1,000 Lbs./Sq. In.)	60-85	65-85	80-200	70-90	90-110	75-95	85-135	65-85	115-170
Yield Strength (1,000 Lbs./Sq. In.)	35-45	35-45	60-165	35-55	80-105	45-60	55-115	25-45	90-135
Elongation in 2 In. (%)	25-20	25-20	18-25	25-20	25-8	30-20	25-2	35-25	20-15
Reduction of Area (%)	75-55	75-60	75-60	60-60	—	65-60	—	75-60	60-50
Rockwell Hardness	B75-85	B76-85	C10-41	B75-90	B90-C28	B80-90	—	B70-85	—
Brinell Hardness	170-255	131-163	189-375	145-185	—	140-185	—	130-163	240-370
Keyhole (Charpy Impact) (Ft.-Lbs.)	—	25-35*	—	20-40	—	1-10	—	—	—
Stress for a Creep Rate of 1% in 10,000 Hrs.									
At 1000°F, Lb./Sq. In.	—	9,200*		8,500		6,100		9,500	
At 1200°F, Lb./Sq. In.	—	2,000*		2,200		1,400		2,500	
At 1300°F, Lb./Sq. In.	—	1,300*		1,400		700		1,700	
At 1500°F, Lb./Sq. In.	—	—		—		—		—	
Scaling Temperature, °F (approx.)	1500	1300		1500		2000		1150	
Forging Preheat Temperature, °F	1400-1500	1400-1500		1400-1500		1400-1500		1400-1500	
Initial Forging Temperature, °F	1950-2000	2000-2100		1900-2050		1950-2050		2100-2200	
Finishing Temperature, °F	—	1500 Min.		1500 Min.		1450 Max.		1600 Max.	
Annealing Treatment, °F	Air cool from 1350-1450	Cool 50° per hr. max. to 1000° from 1550-1600 or air cool from 1350-1450**		Air cool from 1400-1500		Rapid cool from 1550-1650		Furnace cool from 1525-1600 or air cool from 1325-1375	
ABRASION RESISTANCE	Fair	Fair						Fair	
COLD FORMING—Drawing—Stamping	Fair	Fair		Fair		Fair		Fair	
MACHINABILITY	Fair	Fair		Fair		Fair		Fair	
WELDING	Good Does not harden to any appreciable extent.	Fair Welding hardens. Anneal to restore ductility		Fair Welds are brittle when cold. Slight response to anneal.		Fair Welds are brittle when cold. Slight response to anneal.		Fair Welding hardens. Anneal to restore ductility	
PRECAUTIONS (See Note)		(A)		(B)		(B)			

*Applies only to Grade 409 and 416.
**Applies only to Grade 409.
(A) Hardening treatment (air cools from 1700°-1850°).
Tempering treatment after hardening should be at a selected temperature within the range 600°-1400°F, depending upon the properties desired.

(B) Preheat ducts to 1400°F and hold evenly to initial temperature for forging. Full corrosion resistance is developed only in the heat treated condition. In forging, anneal every 1/2 hour. Complete grain growth takes place 1600°F. Expert welding is required to avoid excessive grain growth. Prolonged exposure at 800° to 950°F produces loss in ductility. Not suitable for hammer forging.

Typical Properties of Austenitic USS Stainless Steels

USS GRADES:	USS 17-4-4	USS 17-7	USS 18-1-0	USS 18-8, 18-8Mo, 18-8S	USS 18-8L	USS 18-8Mo	USS 18-8Mo	USS 18-8Mo	USS 18-8Cb	USS 25-12	USS 25-20
A.I.S.I. TYPE NUMBERS:	Type 201	Type 301	Type 202	Types 302, 303 and 304	Type 304L	Type 316	Type 316L	Type 317	Type 347 and 348	Type 309	Type 310
PHYSICAL PROPERTIES											
Density											
Lb./Cu.In.	0.29	0.29	0.29	0.29		0.29		0.29		0.29	0.29
Low Carbon Steel (SAE 1020)=1.00	1.02	1.02	1.02	1.02		1.02		1.02		1.02	1.02
Specific Electrical Resistance at 68°F											
Microhms/Cm.³	70.5	72	71.1	72(1.a lnx73.8(2)		74		77		78	80
Microhms/In.³	—	27.6	—	28.4(1.a lnx 27.6,32.3)		29.2		29.5		30.7	31.5
Low Carbon Steel=1.00	—	—	—	5.6		5.8		6.5		7.1	7.1
Melting Range °F	2550-2650	2550-2690	2550-2650	2550-2650		2500-2590		2550-2600		2550-2650	2550-2650
Structure	Austenitic	Austenitic	Austenitic	Austenitic		Austenitic		Austenitic		Austenitic	Austenitic
Magnetic Permeability as Annealed	1.004**	1.003**	1.005*	1.003*		1.003*		1.003*		1.004*	1.003*
Specific Heat											
Cal./°C/Gm. (0 to 100°C) OR											
Btu/°F/Lb. (32 to 212°F)	0.12	0.12	0.12	0.12		0.12		0.12		0.12	0.12
Low Carbon Steel=1.00 (0 to 100°C)	—	—	—	1.1		1.1		1.1		1.1	1.1
Thermal Conductivity											
Cal./Cm.²/Sec./°C/Cm., at 100°C	—	—	—	0.0390		0.0470		0.0406		0.033	0.033
Btu/Sq.Ft./Hr./°F/In. at 212°F	9.4	9.4	9.4	113		113		112		96	96
Low Carbon Steel=1.00, at 100°C	—	—	—	0.36		0.36		0.33		0.29	0.29
Cal./Cm.²/Sec./°C/Cm., at 500°C	—	—	—	0.0612		0.0812		0.0632		0.045	0.045
Btu/Sq.Ft./Hr./°F/In. at 932°F	—	12.4	—	149		149		154		130	130
Coefficient of Thermal Expansion											
Per °F x 10⁻⁶ (32 to 212°F)	8.7	9.4	—	9.6		8.9		9.3		8.3	8.0
Low Carbon Steel=1.00 (32 to 212°F)	1.32	—	—	1.45		1.35		1.41		1.26	1.21
Per °F x 10⁻⁶ (32 to 932°F)	10.1	10.1	10.6	10.2		9.7		10.3		9.8	9.6
MECHANICAL PROPERTIES AT ROOM TEMPERATURES	¼ Hard	½ Hard	¾ Hard	Full Hard	An-nealed	An-nealed	Cold Worked	An-nealed	An-nealed	Cold Worked	An-nealed	321 Annealed	347 & 348 Annealed	An-nealed	Cold Worked	An-nealed
Endurance (Fatigue) Limit (1,000 Lbs./Sq.In.)	—	—	—	80-100	—	30-55	40-120	35-45	30-50	40-120	37-47	35-55	35-65	35-60	—	—
Modulus of Elasticity (1,000 Lbs./Sq.In.)	Type 201=28.5	Type 301=28.5			28	28	28-26	28	26	28-26	28	28	28	29	29-26	29
Tensile Strength (1,000 Lbs./Sq.In.)	175,000‡	150,000‡	175,000‡	185,000‡	90-110	75-95	125-300	70-90	80-95	125-300	75-95	75-95	80-100	85-100	115-175	90-105
Yield Strength (1,000 Lbs./Sq.In.)	75,000‡	110,000‡	135,000‡	140,000‡	55-60	30-45	80-250	25-40	30-45	60-250	30-45	30-45	35-50	35-50	65-230	40-60
Elongation in 2 In. (%)	25‡	18‡	12‡	9‡	60-50	60-50	50-2	50-60	60-40	50-2	45-55	55-45	50-40	55-40	25-2	45-30
Reduction of Area (%)	—	—	—	—	75-60	85-30	75-60	75-60	70-55	65-30	70-55	75-55	70-50	65-50	65-20	65-45
Rockwell Hardness	C25‡	C30‡	C37‡	C41‡	885-100	875-90	C5-58	875-90	875-90	C5-40	875-85	875-90	875-90	860-90	C5-40	860-90
Brinell Hardness	—	—	—	—	183-241	195-185	—	—	195-185	—	—	195-185	195-185	192-185	—	192-185
Keyhole (Izaxy Impact (Ft.Lbs.)	—	—	—	—	—	75-90	—	75-90	60-80	—	60-80	70-90	50-70	65-80	—	65-80
Stress (1,000 psi) for a Creep Rate of 1% in 10,000 Hrs.																
At 1200°F, Lb./Sq.In.	—	—	—	—	17,600**	—	—	24,200	—	—	24,500	32,500		19,900		18,200
At 1200°F, Lb./Sq.In.	—	—	—	—	6,900**	6,800		12,700	8,200		9,700	14,500		8,300		8,600
At 1300°F, Lb./Sq.In.	—	—	—	—	3,900**	3,500		7,800	4,800		5,150	9,800		4,800		5,000
At 1500°F, Lb./Sq.In.	—	—	—	8,200	1,400**	1,500		2,800	1,900		2,000	2,000		1,000		1,000
Scaling Temperature, °F (approx.)	1500	1500	1550	1650	1650	1650		1650	1650		1650	1650		2000		2000
Forging Preheat Temperature, °F	1600-1400	1500-1600	1500-1600	1500-1600	1500-1600	1500-1600		1500-1600	1500-1600		1500-1600	1500-1600		1600-1400		1500-1600
Initial Forging Temperature, °F	2150-2300	2100-2300	2150-2300	2150-2300	2150-2300	2150-2300		2150-2300	2150-2300		2150-2300	2150-2300		2000-2250		2000-2250
Finishing Temperature, °F	1600-1700	1600-1700	1600-1700	1600-1700	1600-1700	1600-1700		1600-1700	1600-1700		1600-1700	1600-1700		1700-1800		1700-1800
Annealing Treatment, °F	1850-1950 and Quench	1900-2000 and Quench	1850-1950 and Quench	1900-2000 and Quench	1850-2050 and Quench	1850-2050 and Quench		1850-2050 and Quench	1850-2050 and Quench		1800-2025 and Quench	1750-1950	1850-2050	2000-2100		2000-2100
ABRASION RESISTANCE	Good	Good	Good	Good	Good	Good		Good	Good		Good	Good		Good		Good
COLD FORMING—																
Drawing—Stamping				Excellent as Annealed. Decreases with increasing cold work.	Excellent as Annealed. Decreases with increasing cold work.	Excellent as Annealed. Decreases with increasing cold work.		Good as Annealed. Decreases with increasing cold work.	Good as Annealed. Decreases with increasing cold work.		Same as Type 302.	Good		Good		Good
MACHINABILITY	Fair	Fair	Fair	Fair: Type 303 Superior	Fair	Fair		Fair	Fair		Fair	Fair		Fair		Fair
WELDING	Satisfactory			Satis-factory	Types 302 and 304 very good. Type 304 superior in corrosion-resistance "as welded."	very good not necessary to anneal.		very good	very good		very good not necessary to anneal.			very good		very good
PRECAUTIONS (See Note)	(B)	(A)	(A)	(B)	(A) (B)	(A)	(B)	(A)	(A)	(B)	(A)	(A)		(A)	(B)	(A) (B)

Note Numbers:
Using metal in a condition of thermal composition and section size and ductability with cold work.
Recommended for Type 302).
Resistance reliable.

(A) Preheat heavy sections slowly to 1200°F, then heat rapidly to the desired forging or annealing temperature.
(B) Cooling rate should be as rapid as possible consistent with freedom from cracking. Water quench when maximum resistance to corrosion is desired.
In the temperature range of 800° to 1200°F should be avoided if optimum corrosion resistance is desired.

Title:
CONCEPTS

Author:
Mead, Syd

Publisher:
U.S. Steel Company

Date Published:
[1961]

Dimensions:
26.7x34 cm (10½x13½")n.

A rare promotional book from the U.S. Steel Company, one of five different books Mead produced for them, meant to influence automobile designers and engineers. Mead's designs apply space age ideas to the terrestrial future. It exhibits US Steel's midcentury vision of the future for steel technology as applied to cars and multi-purpose vehicles.

Sydney Jay Mead was an American industrial designer and neo-futuristic concept artist, widely known for his designs for science-fiction films such as Blade Runner, Aliens and Tron.

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